

The

JULY 1942

TOOL ENGINEER

MACHINERY • PRODUCTION • TOOLS

FOR THE
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THESE ARE THE NO. 1 JOBS
FOR THE TOUGH CUTTING EDGE OF

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"TOPS IN TOOL STEELS"

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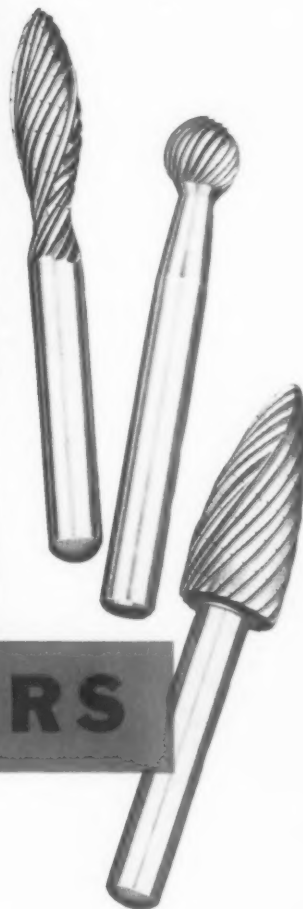
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Three hand cut burs . . . when we received them they were dull — the "bite" was gone. Kellerflex converts these worn burs into good-as-new ground burs. The same treatment can be administered to mill cut or ground burs.



Here are the three burs after Kellerflex reconditioning. They have restored their cutting quality. New teeth have been ground . . . clean and sharp. They are ready for another useful life on the production line. And when the need it they can be resharpened time and time again.



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KELLERFLEX recut burs
conserve vital metals . . . Cut Costs

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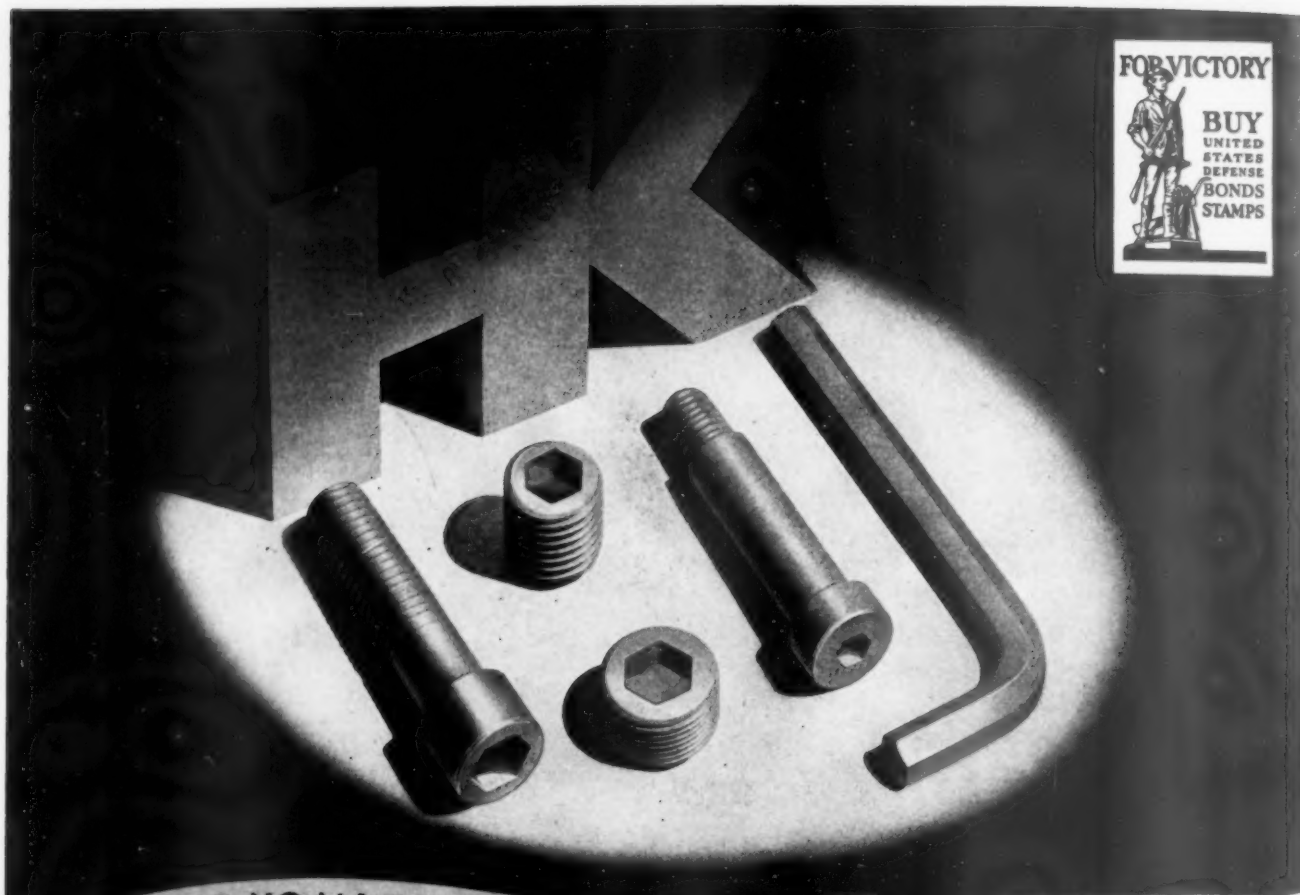
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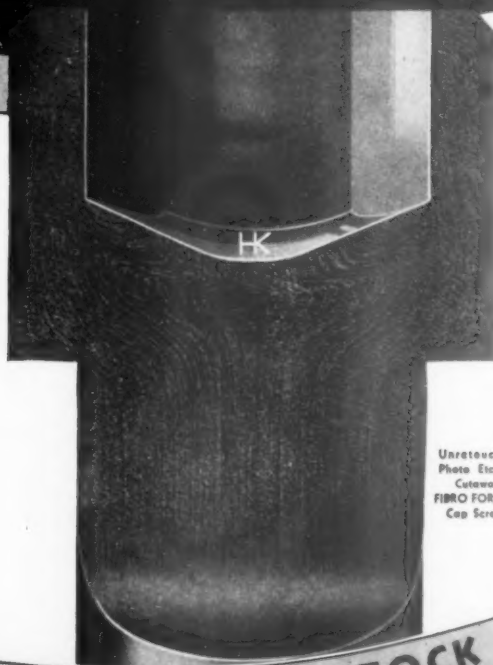
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THE TOOL ENGINEER

Volume XI

JULY, 1942

Number 7

• Articles

Great Lakes Shipbuilding	67
Drilling Magnesium Alloys	71
Broaching, On the Production Front	73
Broach Design	74
Broaching Applications	80
Yesterday, Today and Tomorrow	87
Questions and Answers on Shop Practise	88
Applied Tool Engineering	92
Sharing 'Know How'	94
Optical Glass For War	96
Larson's Luck Holds	101
Magnetic Inspection	103
Industrial Training	104
Old and New Welding Techniques	105
Method of Making a Spring Clip	116

• Editorial

Fifty to One	65
--------------------	----

• Features

Tool Engineering Data Sheets	97
Production Perspectives	123
Greenie—Cartoon Feature	123
Washington Letter	131
A.S.T.E. Doings	136
New Equipment	146
Handy Andy Says	166
New Literature	170
The Crib	180
Passing Parade	186

• News

Production Perspectives	123
Washington Letter	131
Classified Advertising	192
ADVERTISERS' INDEX	194



One hundred and fifty-six years ago this month a small, intrepid group of men declared the independence of the United States. Today, 130,000,000 strong, that nation is engaged in a world-wide struggle to preserve the way of life its founding fathers fought for. The outcome may well depend on America's shipbuilding program. Certain applications of production methods to shipbuilding are described in this issue of The Tool Engineer.

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500% Faster
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This Grinder is an accurate, inexpensive tool for fast, precision grinding of single flute cutters. It is also used for grinding extremely sharp pointed punches. Interchangeable tool heads are available for a wide range of work.

GORTON CUTTER GRINDER 265-5
With Collet Type Tool Head 276-1 **\$196⁰⁰**
Price Complete

For precision grinding, single flute cutters—an accurate tool of best materials and workmanship. Equipped with cartridge type precision spindle—hardened and ground. Write for complete data as offered below.

COUNTERSINK GRINDING DATA

MACHINE—Gorton Cutter Grinder 265-5.

PART—Special Countersink.

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OPERATION—Grind Point.

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GRINDING TIME—8 to 10 Min.

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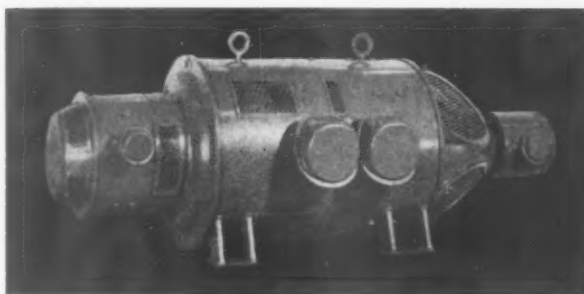
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PLANER DRIVE**

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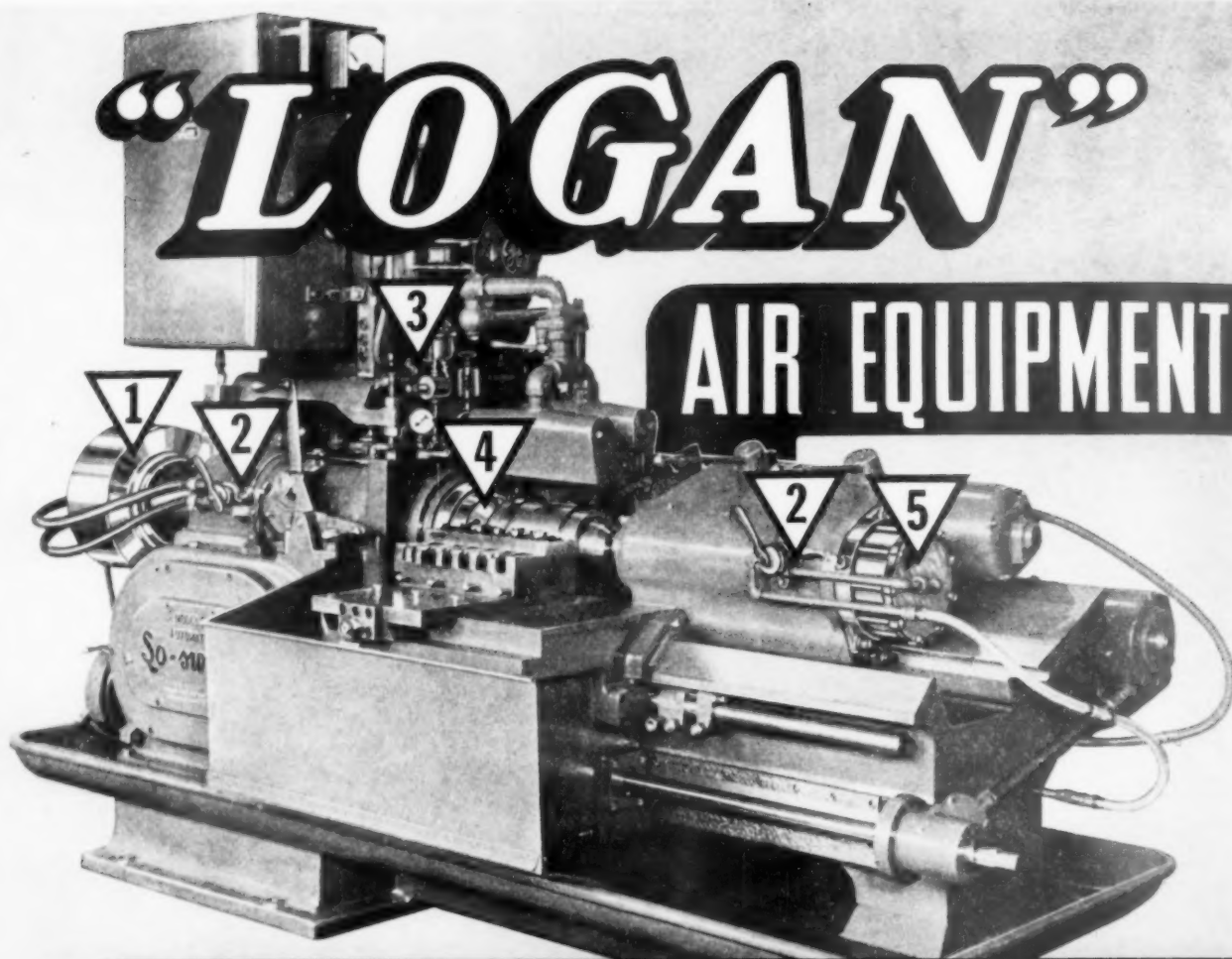
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J-21202

VARIABLE VOLTAGE DRIVES

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4. “Logan” Six Jaw
Expanding Mandrel
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Air Cylinder



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CONDENSED CATALOG No. 42

**Lo-swing
LATHES**

AUTOMATIC LATHES ★

SEMI-AUTOMATIC LATHES

ENGINE LATHES ★

SPECIAL-PURPOSE LATHES

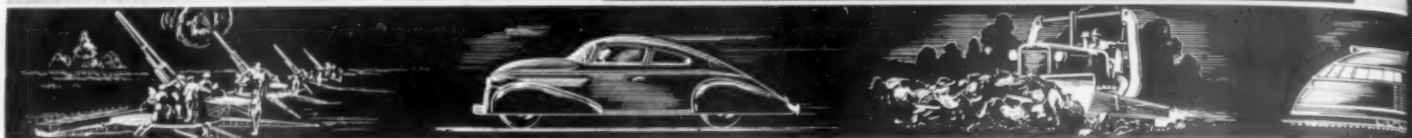
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LATHE NEWS from SENECA FALLS

VICTORY PRODUCTION SPECIFIES MICROHONED BORES

*keep 'em round
keep 'em straight
keep 'em interchangeable
keep 'em rolling
keep 'em firing*



Micromatic Hones range from sizes for bores .303" to 30" in diameter—from 1/4" to 900" long. They remove stock at the average rate of .001" per minute on diameter, in usual applications.

Automatic Microsize Control is available for bores up to 2" in diameter and 6" long, to hold uniform size within .0005" in production.

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Microhoning reduces processing time cost for some applications by approximately 90% over previously used methods of processing. Send for Bulletin AR-60

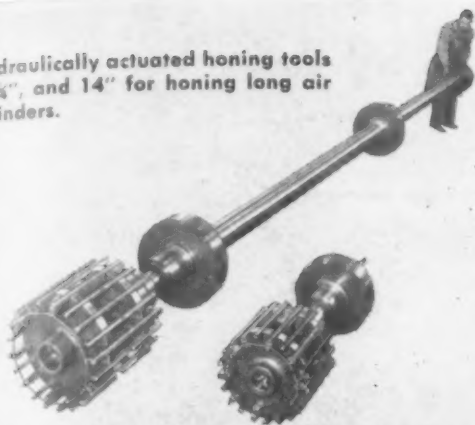


**SAVE TIME
SAVE METAL
SAVE COST
IMPROVE QUALITY**

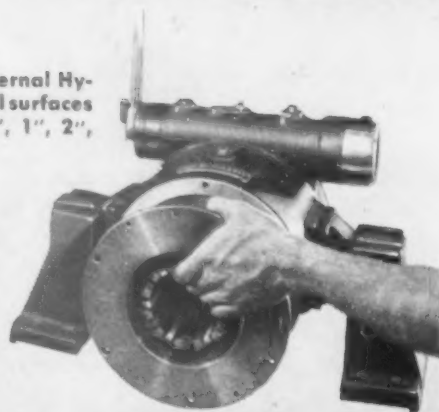
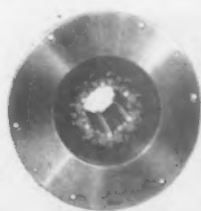
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MICROHONING**

MICROMATIC HONE

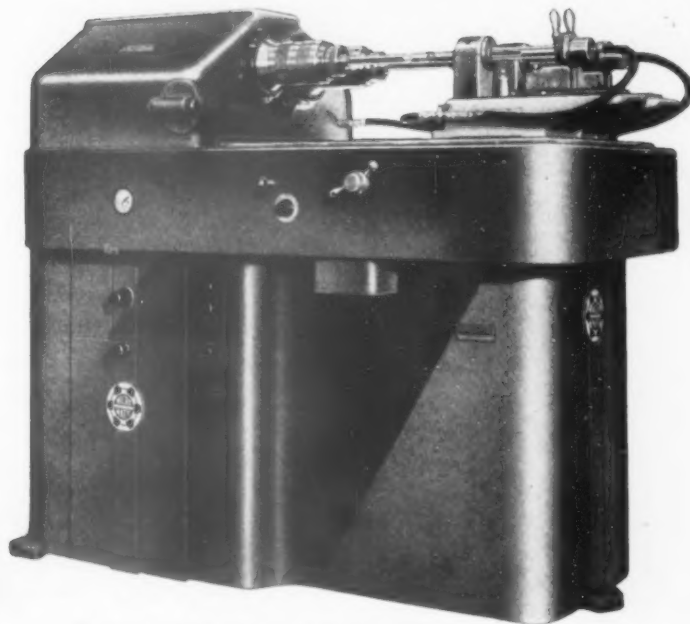
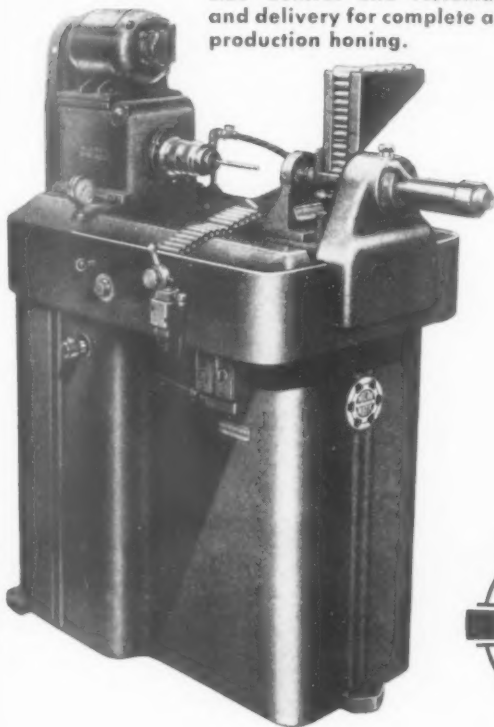
Hydraulically actuated honing tools
18 $\frac{1}{2}$ " and 14" for honing long air
cylinders.



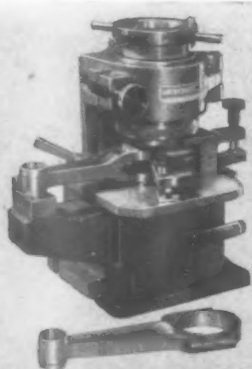
Hydraulically actuated external Hy-
drohone for honing external surfaces
of shafts for diameter $\frac{3}{4}$ ", 1", 2",
2 $\frac{1}{2}$ " and 3".



Model 200 Hydrohoner with Micro-
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and delivery for complete automatic
production honing.



Model H-2 Micromatic Hydrohoner
arranged with Microsize Control
Units for honing certain gun tubes.



Micromatic Huttohones and fixture
for honing fork and blade connect-
ing rod bores used in straight line
aircraft engines.



Hydraulically actuated Hydrohones,
sizes 5 $\frac{3}{8}$ ", 5 $\frac{1}{2}$ ", 4 $\frac{1}{2}$ " and 3 $\frac{1}{2}$ " for
honing tractor engine sleeves in
high production.



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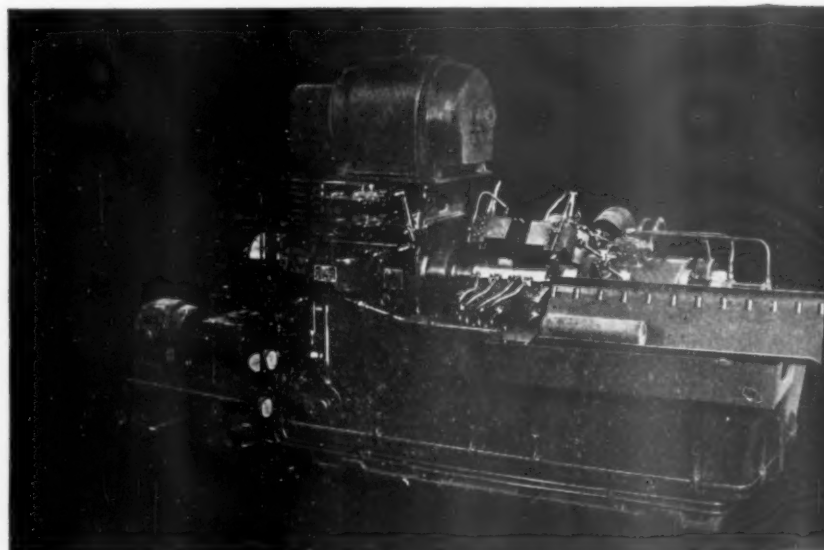
Detroit, Michigan

"PLEASE POST THIS IN



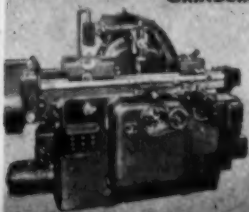
"The Lamson Catalog of 1865"

NEITHER Jones & Lamson nor its early predecessors has ever been backward about keeping industry informed of the newest developments in their machine tool line. When American missionaries were first bringing the Bible to heathen lands, Vermont machine tool men afoot, on horseback, flatboat and stagecoach were tooling infant industries on the frontiers of America. Sometimes these hardy salesmen ran out of cash on the road. One of them labored for weeks as a bartender in a hotel to earn money to travel on. Today Jones & Lamson representatives travel by auto, rail and air, but they are no less eager than their predecessors to bring you information of new ways to speed production.



Jones & Lamson 16" Fay Automatic Lathe tooled to machine a shell.

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS



JAM TYPE UNIVERSAL TURRET LATHE



A CONSPICUOUS PLACE"

THE machines shown in this catalog are no longer made. But there is one item worth remembering that can help you meet today's emergency and safeguard future earnings in postwar competition.

Now, as in 1865, Jones & Lamson equipment offers advances in machine design and precision workmanship that enable you to take every possible advantage of available cutting tools.

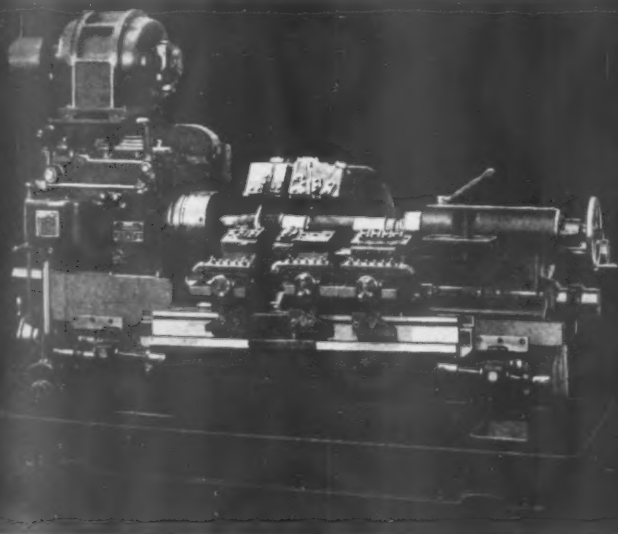
Specifically, Jones & Lamson Turret Lathes, Fay Automatic Lathes and Automatic Thread Grinding Machines embody

numerous refinements that make for rapid, effortless low-cost operation. Into them are built excess reserves of speed, rigidity and useful power that permit maximum employment of any hard alloy tool or high speed grinding wheel now made, or likely to be made in the near future.

Detailed information of these features is available in the newest illustrated Jones & Lamson catalogs. Inquiries from large plants or small receive careful study here. It pays to put production problems up to Jones & Lamson engineers.

JONES & LAMSON

MACHINE COMPANY • Springfield, Vermont, U.S.A.



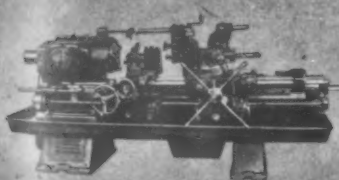
Jones & Lamson 16" Fay Automatic Lathe tooled to machine a rear axle housing.

*Manufacturers of Ram & Saddle Type
Universal Turret Lathes . . . Fay Auto-
matic Lathes . . . Automatic Thread
Grinding Machines . . . Comparators
. . . Automatic Opening Threading
Dies and Chasers*

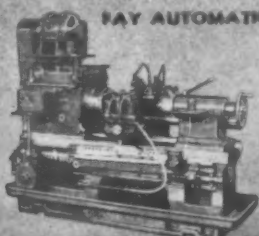


**PROFIT PRODUCING
MACHINE TOOLS**

**SADDLE TYPE
UNIVERSAL TURRET LATHE**



FAY AUTOMATIC LATHES



AUTOMATIC OPENING




Firth-Sterling

ANNOUNCES

**ANOTHER SUBSTANTIAL REDUCTION
IN FIRTHITE TUNGSTEN-TITANIUM
CARBIDE PRICES**

**SINTERED
TUNGSTEN  TITANIUM
CARBIDE
FOR STEEL CUTTING**



THE established Firthite policy has been not only to improve the quality of its products but also to lower the cost to the ultimate user.

Here is the most recent example—a real step forward that is still further extending the use of sintered carbides for STEEL CUTTING.

QUALITY IMPROVED—After many years of research on the addition of Titanium to sintered carbides, we offer certain grades of Tungsten-Titanium Carbides that set new performance standards in the machining of steel.

PRICES LOWERED—The wider use of Firthite Tungsten-Titanium Carbides in

the TA, T-04, and T-16 Grades has resulted in lower processing costs. TITANIUM, itself, costs less than other ingredients. It is abundantly available from domestic sources. The more of it we use, the less dependent we are on imports of scarce metallic ingredients from foreign countries.

NEW METHOD OF PRICING—Heretofore, in pricing sintered carbides, differences in manufacturing costs have not been recognized. In our new method of pricing, we take into account the foregoing economies—and pass them on to you. (We believe that we are the first in the industry to do this.)

TUNGSTEN-TITANIUM CARBIDE GRADES

PRICES ARE REDUCED ON:

GRADE T-04

Closest approach to a universal grade. Especially recommended for heavy duty, interrupted cuts, coarse feeds, etc.

GRADE TA

General-purpose material for cutting steel—cast, rolled, and forged. Light, intermittent cuts.

GRADE T-16

For light, rapid finishing of harder steels.

ABOVE PRICE CHANGES DO NOT APPLY ON:

GRADE T-89

GRADE T-90

These are Tantalum* -Titanium - Tungsten Carbide grades, and are sold for some steel-cutting applications.

*Tantalum is now on the "allocated" scarce materials list.

FOR LATEST PRICES,
SEE THESE NEW BULLETINS:



Firth-Sterling

STEEL COMPANY

OFFICES: MCKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

ARMY



NAVY

Star of our

Telegraph

All America Cables
Canadian Pacific Telegraphs

THIS IS A FULL RATE TELEGRAM, CABLE-GRAM OR RADIOGRAM UNLESS OTHERWISE INDICATED BY SYMBOL IN THE PREAMBLE OR IN THE ADDRESS OF THE MESSAGE. SYMBOLS DESIGNATING SERVICE SELECTED ARE OUTLINED IN THE COMPANY'S TARIFFS ON HAND AT EACH OFFICE AND ON FILE WITH REGULATORY AUTHORITIES.

Form 16 L

CS 242 TWS PD 3 MINS GOVT
PBR FTHAYES OHIO MAY 20 748 PM

THE MANAGEMENT AND EMPLOYEES OF THE NATIONAL ACME CO., CLEVELAND OHIO. THE ARMY AND NAVY ARE PROUD TO INFORM YOU THAT THE ARMY AND NAVY STAR IS TO BE AWARDED TO YOU IN RECOGNITION OF YOUR FINE WAR PRODUCTION RECORD. YOUR TOOLS HAVE AIDED IN THE PRODUCTION OF PLANES, TANKS, GUNS AND SHIPS WITH WHICH OUR FIGHTING FORCES ARE CARRYING ON. THE ARMY AND NAVY ARE LOOKING TO YOU AS SOLDIERS OF PRODUCTION FOR THE ESSENTIAL TOOLS AND THE ESSENTIAL WEAPONS. WE KNOW YOU WILL CONTINUE TO RESPOND AND NOT ONLY KEEP UP BUT IMPROVE YOUR PRESENT FINE RECORD. OUR CONGRATULATIONS.

PATTERSON, UNDER SECRETARY OF WAR,
FORRESTAL, UNDER SECRETARY OF THE NAVY,
WASHINGTON, DC.



AT PRESENTATION ceremonies in National Acme plant, F. H. Chapin, President (center) and M. Bizovsky, local MESA president (left), accepted the award on behalf of their fellow workers. To James Forrestal, Under-Secretary U. S. Navy, and Col. S. E. Reimel, Army-Navy Munitions Board, they pledged continued full support of Nation's war effort.



WORKERS CHEERED compliments on their achievement by Cleveland's Mayor F. J. Lausche (speaking) and by high-ranking Army and Navy officers. They went back to their jobs with renewed determination to beat their phenomenal machine and tool production record, which has already increased over 600%.



inspiration to even greater effort



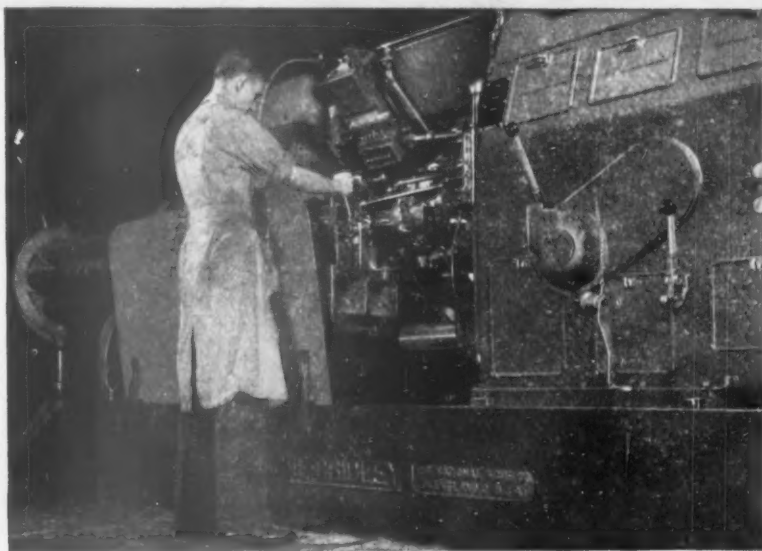
PROUDLY now the Army-Navy Star burgee flies over NAMCO plant; proudly, too, every man will wear a lapel button denoting his part in the primary job of getting munitions and equipment to the men at the fighting fronts.

"MORE Output Per Day and More Bonds Per Pay" is the slogan at The National Acme Co. Subscriptions via pay roll deductions alone now exceed \$10,000 per week. Photo shows Harry Mack, father of a U. S. Navy volunteer, buying another war bond.



AXIS-BUSTING munitions parts shown below are but a few of many now being made on Acme-Gridley Bar Automatics to exacting U. S. Army and Navy specifications. 42 years of successful experience stand behind today's amazing speed, accuracy and low operating cost of these machines.

SPEED—ever greater speed—but at no sacrifice of accuracy—is today's vital war production demand. And Acme-Gridley Automatics are helping to meet the Nation's need by sustaining accuracy at fastest feeds and highest spindle speeds that modern cutting tools can safely stand.



THE **NATIONAL ACME** CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING





MIDWEST MILLING CUTTERS AND HOW BEST TO USE THEM

HEAVY DUTY PLAIN MILLING CUTTERS—This type of cutter is recommended where there is heavy production milling of materials in soft or alloy steel, bronze or copper. They have coarse pitch, undercut teeth with maximum backing behind cutting edges and ample chip space.

Midwest standard heavy duty mills have a smooth cutting action; they set up an end thrust which keeps the spindle tight in its bearings and eliminates chatter because they are made with 45° left-hand spiral teeth.



HALF SIDE MILLING CUTTERS—a type for heavy-duty straddle milling operations where only one side of the cutter is required for milling; also used frequently in pairs to mill a slot to fixed width but where finish at bottom is not important.

These mills have spiral, undercut teeth which provide particularly free-cutting action. Compared with side milling cutters, these half side mills show lower power consumption, more pieces per grind, and less idle machine time due to cutter changes.

STAGGERED TOOTH SIDE MILLING CUTTERS—This type of mill is exceptionally free cutting. For that reason it is ideal for deep slotting or the milling of keyways. The top teeth are undercut and have an alternate right and left-hand helix angle, which greatly reduces end thrust.



Since drag ends (inefficient tooth portions) are eliminated, increased chip room is obtained, and chip lengths are broken up, giving them the characteristic snap out of the cut. The sides of the teeth having no cutting action are "dished"

slightly toward the recessed part of the cutter and this eliminates "bugging" of the cutter sides and, in turn, scoring the sides of the slot.

Many other types and forms of metal cutting tools are made by Midwest; catalog No. 17 contains illustrations and extensive information on them.

Any metal cutting problem inquiry you make will be carefully studied and analyzed. Suggestions and recommendations will be returned to you on types of tools to employ and how best to use them—a Midwest service entering its 31st year.

MIDWEST TOOL & MFG. CO.
2364 W. Jefferson Ave. Detroit, Mich.



END MILLS • SLEEVES • COUNTERBORES • DRILLS
SPECIAL TOOLS • REAMERS • FORM TOOLS
CARBIDE TIPPED TOOLS • ADJUSTABLE HOLDERS



Precision METAL CUTTING TOOLS

**WINNING
TWO WARS
AT ONCE!**



• American aerial bombs are bursting on a score of Freedom's battlefields. And hot off the presses are coming more and more shells, cartridge cases and parts for planes, tanks, guns and ships.

• Tough veteran fighters on the production line are Elmes hydraulic presses . . . performing all kinds of forging, forming and pressing operations with speed and accuracy. That's the Elmes' role in the war on tyranny. But there's another war . . . the ceaseless war on Production Costs. Here, too, Elmes Hydraulic Presses, Accumulators, Pumps and other products have a grand record for low-cost performance. Built into every Elmes product is an unquenchable belief in quality and 91 years of practical *knowing how* to produce it.

• Any time is a good time to discuss production problems with Elmes engineers. Now, for instance.

**CHARLES F. ELMES
ENGINEERING WORKS**

229 N. Morgan St. • Chicago, Illinois

Also Manufactured in Canada

WILLIAMS & WILSON, LTD., Distributors

Since 1851
Elmes

METAL WORKING PRESSES • PLASTIC MOLDING PRESSES • PUMPS
EXTRUSION PRESSES • ACCUMULATORS • VALVES • ACCESSORIES



TO PLANT SUPTS.

This is one of a series of ads addressed primarily to new grinder hands. If you would like additional copies without our signature, for your bulletin board, tell us how many you need.

How to get better and longer service from your grinding wheels...

● The war imposes a double task on industry and a patriotic responsibility on grinder hands. Speed of production has to be increased, without waste of basic materials. With grinding playing such an important part in production, these simple rules may help you do your job better!



1 USE THE RIGHT WHEEL IN THE RIGHT PLACE

Given data on the type of grinding job, the character of metal to be ground, the amount of stock to be removed and the finish desired, a grinding wheel manufacturer can give you a wheel in the right grit, grade, grain, bond, shape and size to meet definitely your grinding conditions—a wheel that will last longer, do better work at reduced grinding costs. And sales engineering service will help you to select the right wheel for every job.



2 MAKE SURE YOUR GRINDING SET-UP IS RIGHT ON EVERY JOB

Manufacturer's recommendations should be carefully followed on wheel speed, work speed, proper coolant, wheel traverse, rate of infeed etc. Only the correct balance of these factors gives you the full advantage of properly specified wheels. One of the services performed by grinding wheel sales engineers is to check your grinding conditions on the job and point out the best method of carrying out the grinding operation.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)



HARDINGE
HIGH SPEED
PRECISION LATHE

TIME is a factor . . .



HARDINGE
HIGH SPEED PRECISION
SECOND OPERATION MACHINE

HARDINGE machines



HARDINGE
HIGH SPEED PRECISION
TOOL-ROOM LATHE

Produce PRECISION work



HARDINGE
HIGH SPEED PRECISION
MILLING MACHINE

RAPIDLY!

HARDINGE Precision Machine Tools with preloaded ball bearing spindle construction combine high speed and extreme accuracy. This, and the simplicity of operation, enables relatively unskilled operators to rapidly produce parts to the necessary close limits without expensive tooling.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



TANTUNG "G"

*Where Cemented Carbides
Can't Be Used*

5-METHOD COMPLETE TOOL SERVICE for MAXIMUM PRODUCTION

ECONOMY TOOLS



FULL-WIDTH TOOLS

CUTTING-OFF TOOLS

SPECIAL TOOLS

Where cemented carbide can't be used, Tantung "G" offers the ultimate in maximum production. Figure it out for yourself what it would mean if you could increase your cutting speeds 50% and get six or seven times as many pieces per tool sharpening. These figures are not at all the maximum that is being obtained. And these tools work equally well on non-ferrous metals, cast iron and steels.

It's so easy too, to make the switch to Tantung "G". Tools are available as standard in a wide variety of sizes in solid tool bits, all purpose tools, cutting-off tools, and as blades for inserted tooth milling cutters. Tools to order can be made for the unusual setup.

You owe it to yourself to get full particulars at once.



MILLING CUTTER BLADES

SOLID TOOL BITS



**1
STANDARD
TOOLS**

CEMENTED CARBIDE



**2
MILLED AND
BRAZED TOOLS**

CEMENTED CARBIDE



**3
TOOLS TO
ORDER**

CEMENTED CARBIDE



**4
BLANKS**

CEMENTED CARBIDE

*Prompt Delivery
on Standard Tools*

**VASCOLOY-RAMET
CORPORATION**

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

**TANTALUM-TUNGSTEN CARBIDE
FOR TOOL SERVICE..... Specify**

**Vascoloy
RAMET**

**TOOLS
TANTUNG "G"**

AFTER THE WAR— NO DEPRESSION

We look down the road and plan for the dawn of that better day when peacetime needs will once more be the first line activity of American industry and labor. It is evident that the enormous capacity of our new plants and modern equipment will permit America, for the first time, to make enough of all kinds of goods to go around to all our people.

Post-war costs can be very low because these new factories will be "charged off" by the time the war is over. Furthermore, craftsmanship is on the increase and working with the hand is no longer looked down upon. A vast reservoir of new and improved products will be ready to flow to every corner of the land if the profit motive and the American enterprise system prevail. We cannot tolerate another prolonged depression, interference with business or an economy of scarcity.

There are two schools of thought that are advocating methods of continuously spreading our production among our people. Under one plan, certain academic thinkers would limit production, would subsidize the incompetent plant, the national debt would continue to mount and the profit motive would be stifled. Our capitalist system and democratic processes could not long endure under such a plan.

Another school of thought favors unrestricted free enterprise, elimination of monopolies, corrections of restraints caused by patents, cessation of uneconomic deterrence by unions, a tax program that would encourage new enterprise and a free competitive productive economy.

Business management is putting its house in order for post-war productivity that will be possible if the "doers" and not the politicians predominate in planning.

For peace adaptability, the new process known as Contour Sawing is ideal. Without a single change, each DoAll can be put to work catching up on the vast array of civilian goods that will be in demand as soon as the last shot is fired.

DoAll

WINS THE BATTLE OF

PRODUCTION

● Out of the great American caldron they come in ever-increasing quantities—tanks, planes, jeeps, helmets, guns, bullets.

Behind the allied fighting forces stretch miles of production lines, thousands of modern machine tools, millions of workers on the job 24 hours a day.

Wherever you go you'll find DoAll, the light-weight machine tool that saws through any metal or alloy—steel blocks a foot thick, bars, flats, sheets, tubing, etc. Occupies small space—can be shoved into the regular work line to relieve heavy millers and higher-priced shapers of over-load work. Cuts out special parts and tools without dies. Saws 70 to 80 shapes at one time from stacked sheets.

DoAll is the fastest precision method to remove metal. Does a week's work in a day—a day's work in an hour—an hour's work in 15 minutes.



DoAll saved 18 hours on this job. Production cutoff of angle irons. Former method, torch and grind-off burr.

Flexing bars for Dynamometers. Production cutting from 1" Swedish steel.



Cutting openings in 12 gauge 48" steel tank covers.



IN WAR OR PEACE

DoAll can save you valuable time and money. Let a factory-trained man come to your plant and in a few minutes, show you many ways in which DoAll can increase production.

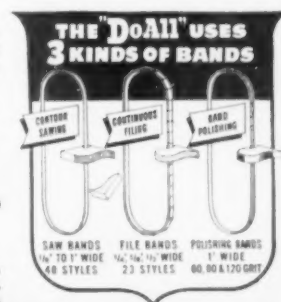
NEW BOOK

Case histories of DoAll performance. Photographically told, with short sentences, for busy executives. Send for copy.

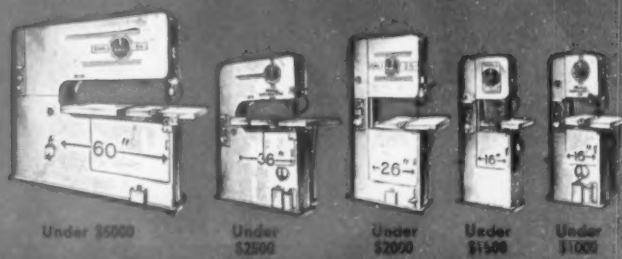
CONTINENTAL MACHINES, INC.

1304 S. Washington Ave.
MINNEAPOLIS, MINN.

Associated with the DoAll Company, Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines



THE EXACT SIZE FOR YOUR JOB



TANTUNG "G"

Where Cemented Carbides
Can't Be Used

METHOD

5

Vascoloy
RAMET
T.M. REG. U.S. PAT. OFF.

5-METHOD

COMPLETE TOOL SERVICE

ECONOMY

FULL-WIDTH TOOLS

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You owe it to yourself to get full particulars at once.

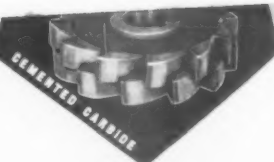
*Prompt Delivery
on Standard Tools*

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

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IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

SOLID TOOL BITS



TANTALUM-TUNGSTEN CARBIDE
FOR TOOL SERVICE.....

Specify

Vascoloy
RAMET

TOOLS
TANTUNG "G"

THE TOOL ENGINEER

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We look down the road and plan for the dawn of that better day when peacetime needs will once more be the first line activity of American industry and labor. It is evident that the enormous capacity of our new plants and modern equipment will permit America, for the first time, to make enough of all kinds of goods to go around to all our people.

Past-war costs can be very low because these new factories will be "charged off"

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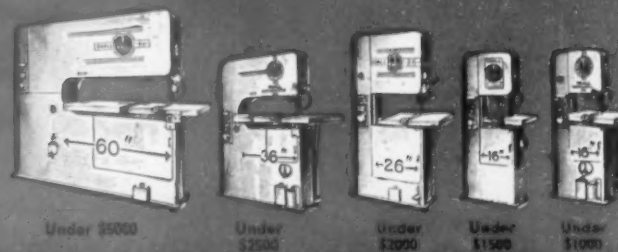
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THE EXACT SIZE FOR YOUR JOB





Where Production Calls for Precision

PRODUCTION for National Defense calls for precision. There can be no sacrifice in accuracy—even with the urgent demand for quick deliveries in vast quantities and the resultant speeding up of production schedules. And all work *must* pass inspection—there can be no scrapping of strategic materials—no delay in delivery—no wasted man power or machine time.

In hundreds of defense industries, precision keeps pace with production, through batteries of South Bend Lathes—like those shown above.

Modern in design, built with extreme precision, South Bend Lathes are fast and accurate on the most exacting classes of machine work. Their wide range of spindle speeds permits machining with maximum cutting tool efficiency. Their versatility facilitates quick change-over through a minimum of set-up time.

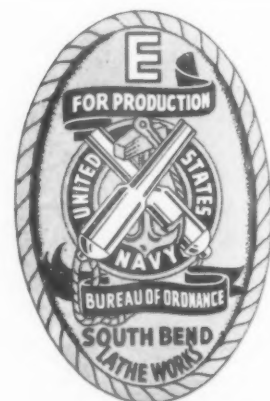
South Bend Lathes are made in five sizes: 9", 10", 13", 14½", and 16" swing, with toolroom or regular equipment. Also turret lathes for multiple tool production operations. Write for catalog and the name of our nearest dealer.

"How to Run a Lathe"



USE THIS
BOOK FOR
APPRENTICE
TRAINING

A practical reference book on lathe operation for beginners and apprentices. 128 pages, 5½" x 8". Price 25c, postpaid.



NAVY "E"

Awarded to the South Bend Lathe Works for outstanding performance in the production of ordnance matériel for the United States Navy.



SOUTH BEND LATHE WORKS

Dept. 924, SOUTH BEND, INDIANA, U. S. A.

L A T H E B U I L D E R S F O R 3 5 Y E A R S

EXCELLENT INVESTMENTS



FOR VICTORY
BUY
UNITED STATES SAVINGS
BONDS AND STAMPS



FOR PRODUCTION

invest a 3-cent stamp to find out the details of the modern line of Lovejoy Milling Cutters — the cutters that thrive on coarse feeds, high speeds, and a 24-hour schedule. It's the solid forged bodies, interchangeable positive-locking blades, and blade economy that make the big difference. Investigate today by using the handy coupon.

LOVEJOY POSITIVE-LOCKING MILLING CUTTERS

LOVEJOY
TOOL CO., Inc.
SPRINGFIELD, VERMONT
U. S. A.

Please mail me the 24-page Lovejoy catalog covering the full line of Lovejoy Mills.

NAME.....TITLE.....

COMPANY

STREET

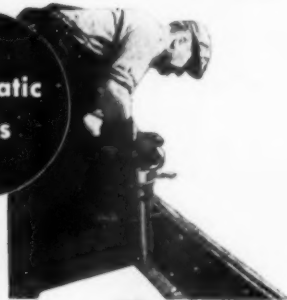
CITY.....STATE.....M.

"how about portable tools in our new plant—which type is best for us?"



BASIC ADVANTAGES of the Three Types of Portable Power Tools

Pneumatic Tools



Available for a wider variety of applications than any other type.
Generally of more rugged construction.
Cannot be damaged by overloading.
Easily stand up under the hardest kinds of heavy duty service.

Universal Electric Tools



Run on ordinary AC or DC electric current which is available almost everywhere.
Offer a wide range of models for all kinds of production and maintenance.
Installation costs generally lowest of all.

High Frequency Electric Tools



Lowest operating costs for users of ten or more tools.
Maintain virtually constant speed under load.
Nature of high frequency current permits simplified construction for light weight, easy handling, reduced maintenance.

● Selecting portable tools while you are still in the *planning stage* of plant expansion is the most sensible way to insure peak production later. For remember, there are three different types of portable power tools—Pneumatic . . . Universal Electric . . . and High Frequency Electric—and one almost certainly offers significant advantages over the others for your particular work.

Which shall it be? Answering this important question calls for specialized knowledge and competent study. It's an assignment that *Thor* is especially well qualified to undertake for you because:

Thor makes all three types of portable power tools.

Thor has the engineering "know how" that comes from building good tools for nearly fifty years.

Thor is working continuously to make the good tools of today

even better tools tomorrow . . . to develop new tools for new applications.

Thor has the trained Service Engineers to put this advisory service into practical operation.

Before you tool up, get this expert, impartial advice. Plan your application of portable tools *in advance*—and get peak production! For further information, without obligation, write Independent Pneumatic Tool Company, 600 W. Jackson Blvd., Chicago, Illinois.

Thor

PORTABLE TOOLS

PNEUMATIC • UNIVERSAL ELECTRIC • HIGH FREQUENCY ELECTRIC

*Let Thor help you
get peak production
with the right type of
Portable Power Tools*

AUTOMATIC CHUCKING EQUIPMENT

tooled for today's fast tempo...

For over 40 years a pioneer specializing in the development of ways and means to improve and speed up production of duplicate parts, Potter & Johnston now takes a prominent place in the tremendous war effort in which metal working industries are engaged.

P&J Automatic Chucking Equipment has been going into the arsenals of democracy in a steady flow and is continuing to add to the productivity of these plants. Parts for all kinds of implements of war are being produced faster and closest degrees of accuracy on P&J machines. Whether for airplanes, tanks, Bofors guns, 90 mm. anti-aircraft guns, machine guns, adaptors for shells or the American Oerlikon gun, Potter & Johnston Chucking Machines are producing parts in ever-increasing volume but always to the highest standard of accuracy and finish demanded.

Potter & Johnston was ready with machines and tooling for the present emergency. We are ready at all times to render our utmost assistance on your production problems because we prepared yesterday to meet today's tempo.



Photo by U. S. Army Signal Corps.

The POTTER & JOHNSTON MACHINE CO.,
PAWTUCKET RHODE ISLAND

500% Increase IN Production

With Precision Boring Machine

A prominent airplane engine manufacturer (name on request) reduced his machining time on the aluminum-alloy accessory housing illustrated at the right, from 30 minutes to 5 minutes per piece.

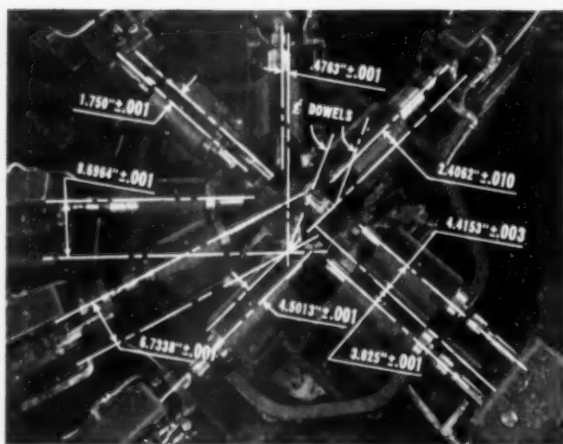
On this 7-way 9-spindle Unit-Type Machine, standard self-contained hydraulic units were used, which may be rearranged to accommodate future changes in the accessory housing.

The Model 75 Self-Contained Hydraulic Unit is designed for Drilling — Reaming — Boring — Face and Hollow Milling — Chamfering and Facing. Deliveries are delayed when ordering is delayed . . . Investigate today — the possibilities of increasing your production with Unit-Type machines. More information will be sent to you promptly—ask for 75 SH folder.



ONE OPERATOR BORES 9 HOLES

An unskilled man, after a few hours of instruction, can operate a Unit-Type Machine. The operator's work usually consists of loading, starting machine from a pushbutton control station, and unloading. Set-up time formerly required for single-spindle boring machines is converted to productive time with Unit-Type machine tools.



The tolerances specified on this job are shown above—yours may be tougher. Send us your part prints with specifications and our engineers will be pleased to make recommendations and aid you in obtaining your specified accuracies while increasing your production.

TYPES OF MANUFACTURERS USING UNIT-TYPE MACHINE TOOLS



Automobiles—Airplanes	Pipe and Fittings
Air Conditioning	Tractors—Trucks
Gun and Armaments	Washing Machines
Pencil Sharpeners	Oil Drilling Equipment
R. R. Equipment	Hydraulic Equipment

Diameters Held to $\pm .0005$ "—Location $\pm .001$ " Angular Location ± 15 Seconds

These close limits of machining on the airplane engine accessory housing presented many difficulties to the manufacturer while using his previous method.

In the Precision Boring Machine the nine precision spindles work simultaneously eliminating the possibility of error resulting from individual settings and numerous gaugings.

The tool is guided in individual bushings. These are mounted close to the work-piece and are doweled and bolted securely in place. Each tool is provided with micrometer adjustment simplifying accurate diameter control.



Save 20 to 35% with Unit-Type Machine Tools

You save engineering and pattern costs on complete feed and drive units, because drawings and patterns are available. • Boring, Drilling, Reaming, Tapping and Milling Operations can be done simultaneously. • Unit-Type machines can be readily rearranged to accommodate future changes in your part design. Write for folder 75 SH on construction and application of 3 H. P. Unit.

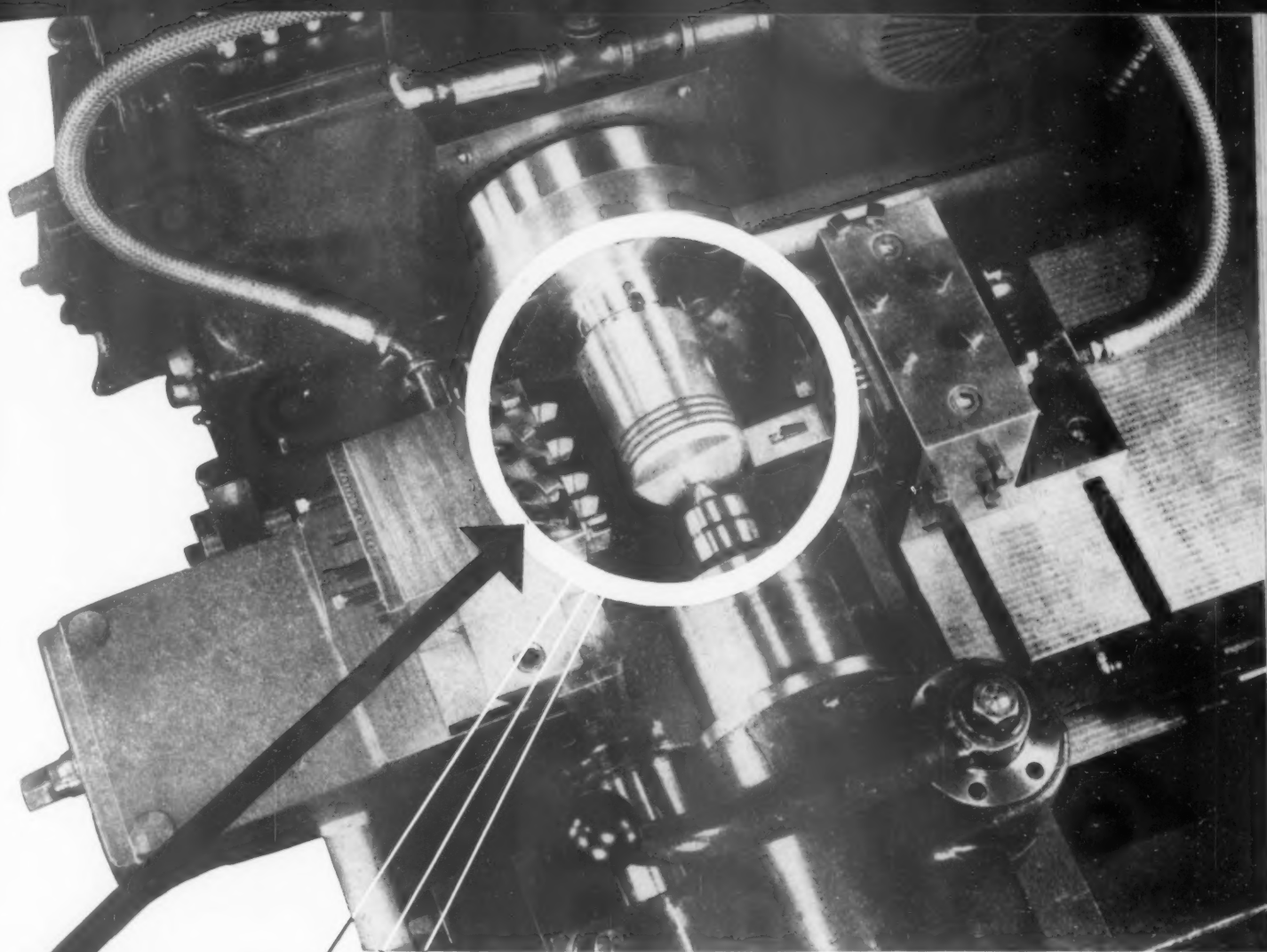
FREE PRODUCTION AND TOOLING IDEAS

Eight bulletins, each describing and tracing a machining problem from the original study of the part to the final machine design will be sent to you upon request. These may prove to be of value to you today, or in the future. Ask for Bulletins on 3-Point Design.



W. F. and JOHN BARNES

325 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.



PISTONS *almost by proxy!*

Within close limits of accuracy, this Gisholt Hydraulic Automatic Lathe is finish-turning and grooving aluminum pistons at the rate of 180 per hour.

YES, here's a machine tool that can substitute and release skilled hands for other important work. It's the Gisholt Hydraulic Automatic Lathe.

By stepping up output and reducing per-piece machining time, the Gisholt Hydraulic Automatic Lathe brings you new low cost

advantages. If you have pistons, bearings, gears, pinions or other round parts to be produced in quantities, ask a Gisholt representative for all the facts.



GISHOLT MACHINE COMPANY

1229 EAST WASHINGTON AVENUE • MADISON, WISCONSIN

Look ahead . . . keep ahead . . . with Gisholt improvements in metal turning

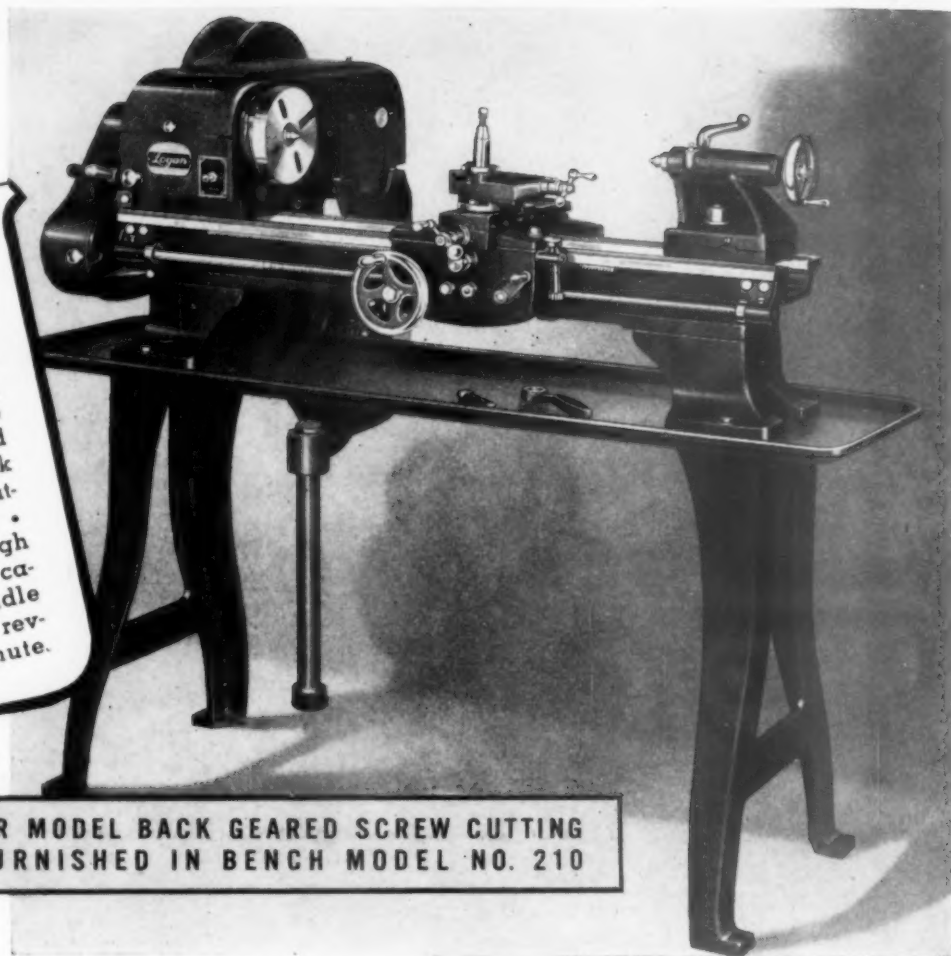


TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES



SPECIFICATIONS

10" swing; 24" between centers • Bed 6 15/16" wide by 43 1/8" long • Prismatic V and flat ways, hand scraped and honed • New Departure precision pre-loaded ball bearing headstock spindle • Thread cutting, 4-216 per inch • 25/32" hole through spindle, 1/2" collet capacity • 12 spindle speeds, 30 to 1450 revolutions per minute.



NO. 200 LOGAN FLOOR MODEL BACK GEARED SCREW CUTTING LATHE • ALSO FURNISHED IN BENCH MODEL NO. 210

A Logan Lathe is a "PLUS" Investment

Advanced streamline design and sturdy construction is your first impression of the No. 200 Logan Lathe. Further study presents convincing evidence of higher engineering standards, better workmanship and a wealth of added features — all of which will pay you extra dividends in continuous precision performance and better shop satisfaction.

LOGAN ENGINEERING COMPANY • Chicago, Illinois

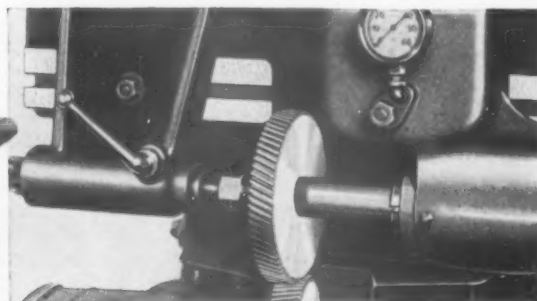
Logan A NAME TO REMEMBER
WHEN YOU THINK OF LATHES

Correct Heat Treat Distortion and Gear Tooth Roughness by

RED RING LAPPING

If lapping is one of the processes used in your gear production, you can save time and cost with a Red Ring Lapping Machine. Its outstanding features are:

- 1 Minimizes rejections by correcting heat treat distortion and eliminates gear noise.
- 2 Applicable to spur and helical gears, cluster and shoulder gears.
- 3 Extremely fast—one minute for a 4" gear with 1" face when reasonably well cut and heat treated.
- 4 Provides for either Cramp or Power Tail stock lapping processes.
- 5 Fully adjustable automatic cycle under hydraulic and electrical control—operator need have no special skill.
- 6 High production laps—lap life 1500 to 3000 units when recut twice.
- 7 May be used on high or low involute teeth and also on the Elliptoid Tooth Form.



Write for descriptive literature.

SPECIALISTS ON SPUR AND HELICAL
INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORMS

**NATIONAL BROACH
AND MACHINE CO.**

RED RING PRODUCTS
5600 ST. JEAN · DETROIT, MICH.

Greenlee **AUTOMATIC NEWS**

PREPARED BY GREENLEE



BROS. & CO., ROCKFORD, ILL.

CORRECT APPLICATION OF CUTTING FLUID INSURES LONGER TOOL LIFE

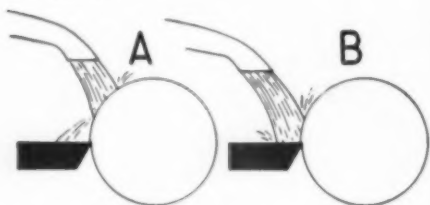
COOLANT IS VITAL FACTOR IN SCREW MACHINE PRODUCTION

The proper selection and application of cutting fluids is perhaps more important today than ever before, because of the faster speeds and feeds used, the use of tough alloy steels in munitions work, the heavy loads on the machines, the 24 hour-a-day operation of the machines, and the absolute necessity for 100% tool cutting efficiency.

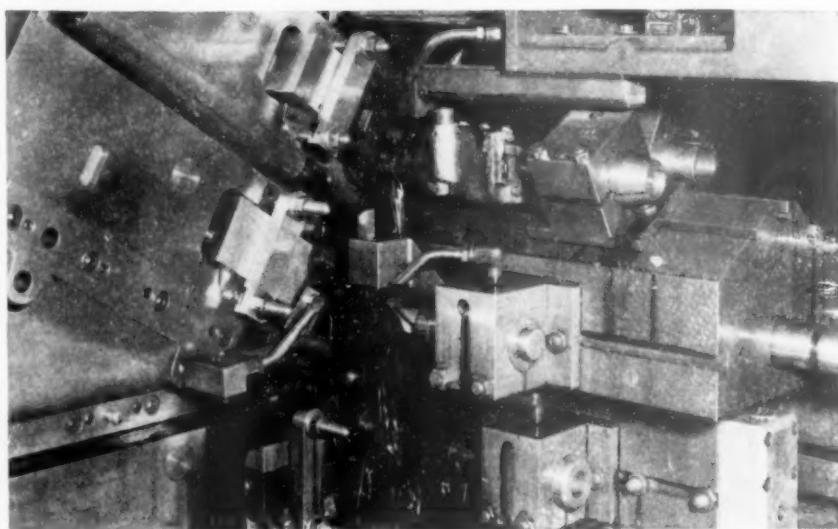
Automatic screw machine users have found that not only is the type of cutting oil used an important factor in obtaining maximum tool life, but that the correct application of the fluid to the tool and work is equally important.

Coolant Must be Applied to Both Tool and Piece

A common fault found in many screw machine departments is that the operator applies the oil only on the work and it is deflected from the tool. Figure A shows how the oil is deflected from the tool when it is incorrectly applied only to the work. Figure B shows how, on the other hand, a correctly applied flow of oil can do an effective job of reaching both the tool and the piece.



When machining at very high speeds, the cutting fluid must be so directed that it will not be carried away from the tool by fast moving chips. This may be accomplished in some cases by piping the coolant from beneath the tool, or by having a flow directed from both sides of the tool.



Here is a set-up view of the Greenlee Six-Spindle Automatic Screw Machine showing a typical application of the cutting fluid for efficient cooling and lubrication of both the tools and piece.

Oil Especially Important In Drilling Work

In drilling work it is important that sufficient oil be applied so as to work its way into the hole. The flow should be directed right into the flute of the drill, and if possible, from both the top and bottom sides of the tool. In this connection, it is well to remember that the coolant pipe should be held as nearly parallel as possible to the drill to prevent deflection of oil from the tool. In deep hole drilling and reaming work, oil drills or oil reamers, with the coolant piped through the tool itself, will give more thorough lubrication of the hole.

When using roller turners make sure that the pipe nozzle is as close to the tool as possible so as to lubricate the rollers as well as the cutting tool and piece.

On threading work it is important that the coolant be run through the die head to wash the chips out of the head.

Proper Temperature Control Adds Hours to Tool Life

The selection of a satisfactory cutting fluid depends upon several factors which may vary from job to job. A careful analysis of each specific job must be made before cutting fluid specifications can be established. The cutting feeds and speeds, the tool hardness, tool shaping, machineability of the metal, and the type of machining operation should all be carefully considered.

Cutting fluids when properly selected and applied will keep the tool cool and prevent it from being heated to a temperature at which hardness and resistance to abrasion are reduced. When temperatures are not properly controlled by coolants, the heat causes the cutting edge of the tool to soften and wear abnormally, which shortens tool life and requires the grinding of excessive stock from the tool when sharpening.

A good cutting fluid will also keep the work cool, preventing it from being machined in a warped shape, it will help provide a better surface finish on the part; it will aid in providing satisfactory chip formation; and it will help wash away chips, particularly in deep hole drilling.

**MULTIPLE-SPINDLE
DRILLING, BORING
AND TAPPING
MACHINES**

Greenlee
BROS. & CO. 
ROCKFORD, ILLINOIS U.S.A.

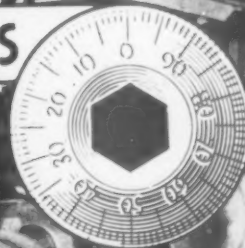
**AUTOMATIC SCREW
MACHINES
AIRCRAFT PRODUCTION
MACHINERY**

YOU AND YOUR TOOLS ARE DECIDING THIS WAR

...Because it takes man power, raw
materials and machines to produce
ships, planes and guns. So let's
not be satisfied with any-
thing less than maxi-
mum production.

DAVIS BORING
TOOL DIVISION
LARKIN PACKER CO., INC.
ST. LOUIS, U. S. A.

DAVIS
BORING TOOLS



Panzers in Peaceful Valleys

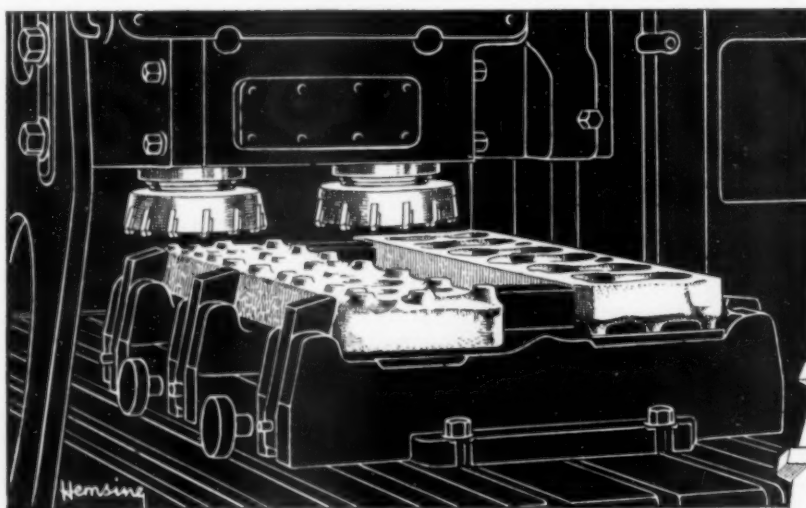
Victory depends not alone
upon the legions at the front.

The mechanized divisions that till
and sow and reap thousands of miles
from the battle fury . . . they, too,
share in the responsibility.

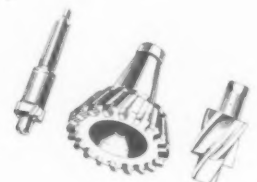
To increase food production and
conserve man-power, these tank corps
of the farm must function smoothly,
without interruption.

Long life is built into them by
implement manufacturers and Gairing
for 25 years has supplied these
manufacturers with the finest
cutting tools . . . tools that
play an important part in
adequately arming panzer
divisions working in
peaceful valleys.

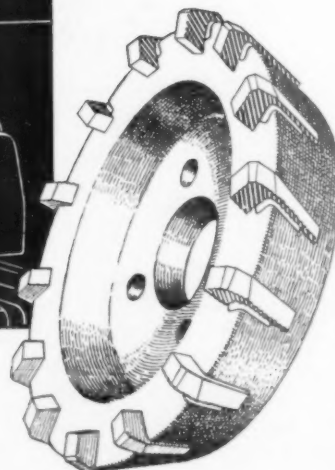
THE GAIRING TOOL COMPANY
Detroit, Michigan



Close-up of GAIR-LOCK
inserted blade milling cutters
simultaneously machining two
tractor engine cylinder heads



Gairing
TOOLS



GAIRING
FOR A
QUARTER CENTURY
SPECIALISTS
IN FINE
CUTTING TOOLS

WHERE *Precision* IS PRICELESS



ES, it's a comparatively small part—a cylinder hold down stud—only one of many threaded hardened pieces that go to make up the powerful engines of today's fighting planes . . . small but vital parts that must be *precision-machined* if

they are to endure the stress that's unavoidable in modern airplane engines . . . this stud (with threads on both ends, tapered and straight, *precision ground* from the solid after heat treat) is typical of thousands of hardened parts being threaded on a production basis day and night for the aircraft industry . . . on *Ex-Cell-O* thread grinding machines . . . to the highest commercial standards of accuracy in size and finish.

EX-CELL-O CORPORATION • DETROIT, MICH.

The modern precision thread grinder is an *Ex-Cell-O* accomplishment, introduced by *Ex-Cell-O* to American industry in 1935. There are nine styles of *Ex-Cell-O* Precision Thread Grinding Machines, covering an extremely wide range of work for both external and internal threads. Below is *Ex-Cell-O* Style 33 Automatic (used for production of precision threaded hardened stud shown above).



XLO

EX-CELL-O *MEANS* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES,
TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES,
BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS



IT DOES THE JOB

on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Brown & Sharpe and Cleveland Automatic Screw Machines.

SOME USERS OF TURNER UNI-DRIVE

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◀ This GEAR BOX is the

TURNER
UNI-DRIVE
Motorizes Machine Tools

The old way is too slow today. More speed... greater production... you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift... save time... speed up work... keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* motor drive.

Easily and quickly installed. They do away with overhead counter shifts... no belts to shift. Increase the efficiency of machine and operator. Drive on large cone at all speeds. One trial will thoroughly convince you.

Right now — today... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

THE TURNER UNI-DRIVE COMPANY

(Sales Division: Turner Machinery Co.)

3416 Terrace St.

Kansas City, Mo.

*"Speeding Production is a cinch with
our new UNI-DRIVES"*



9 out of 10 THREADING JOBS

Can be Ground on the —

DALZEN

**• VERTICAL •
THREAD GRINDER**



This versatile grinder will grind threads up to four inches in length anywhere on an eight inch shaft with a diameter maximum of three inches. The fixture pivots and can be set accurately to a maximum helix angle of 15 deg. either side of center to produce right or left hand threads in standard or special forms.

Note that the Dalzen Grinder is now made with a guard which protects the operator from splashing oil or cutting fluids. Constructed in a vertical position, the head of this grinder is always exerting a downward pressure directly over its base —thus the weight never shifts to alter the line of equilibrium.

And this Dalzen Grinder saves floor space too! Taking little more than half the space formerly required for the production of ground threads, this machine is only 39 inches deep, 43 inches wide, and 72 inches high. Room for more machines!

Dalzen Tool & Mfg. Co., 12255 E. 8 Mile Road, Detroit, Mich.

Note — We also make the Dalzen Combination Center Lapping Machine and Drill Press . . . does the work of 2 machines in the space of one!

No. 2 above

— 43" wide, 39" deep, 72" high — grinds threads to 4" long anywhere on an 8" shaft, diameters up to 3".

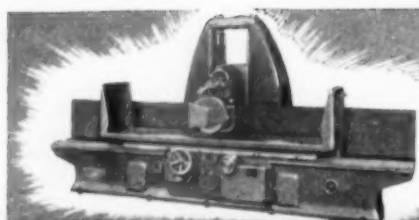
No. 1

— 48" wide, 38" deep, 75" high — grinds threads to 10" long anywhere on an 18" shaft, diameters up to 6".

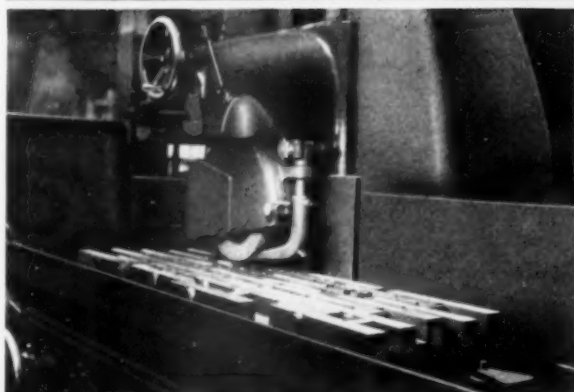
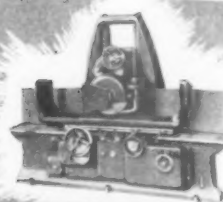
WRITE FOR FOLDER

DALZEN

Do much more • take less floor



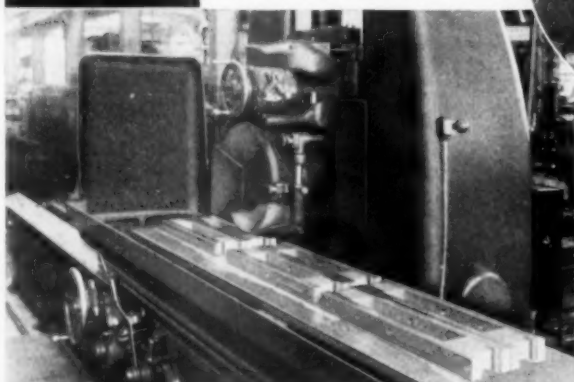
MATTISON HIGH-POWERED PRECISION SURFACE GRINDER



● Cross Slide Draw Bars formerly ground 5 pieces at a time. Now ground on a Mattison Grinder 27 pieces per load. 50% time saving.



● Caps previously ground few at a time on small grinder. Now, Mattison Grinder handles 75 at a time. Time was reduced from 7 hours to 30 minutes.

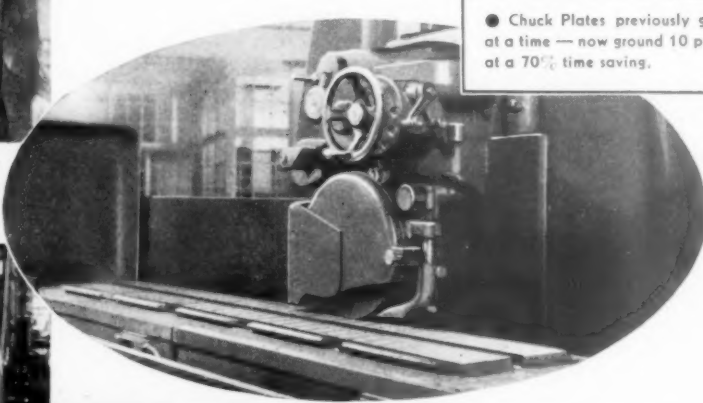


● Head Slide Guides formerly ground one at a time in 36 minutes—Now ground on a Mattison Grinder 9 pieces per set-up at a 77% time saving.

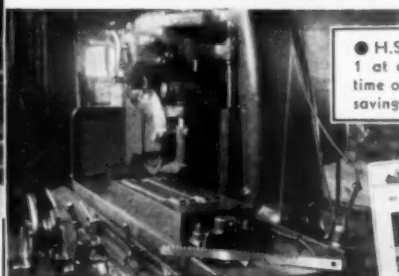
Large Table Space Means More Pieces per Load and GREATER PRODUCTION

Examples: Grinding 75 pieces per load instead of 18 — cut time 80% 10 pieces per load instead of 2 — cut time 70%, etc.

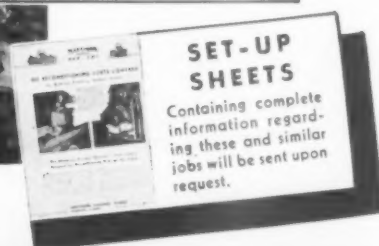
Jobs shown indicate the possibilities for increased production by handling large quantities per set-up. In your efforts to obtain maximum production, it will pay you to check into the capabilities of the Mattison Grinder.



● Chuck Plates previously ground 1 at a time — now ground 10 per set-up at a 70% time saving.



● H.S.S. Broaches previously ground 1 at a time — now ground 10 at a time on a Mattison Grinder, at a time saving of 50%.



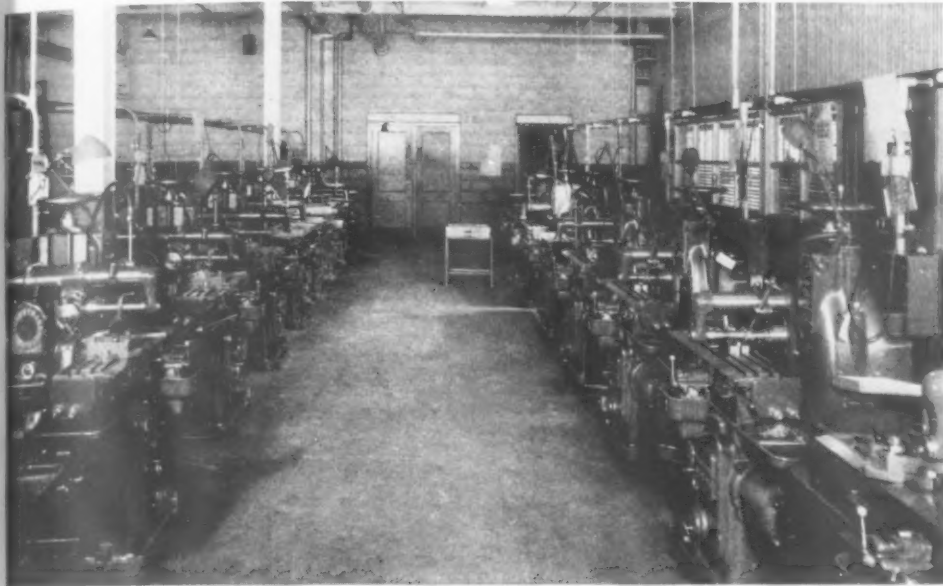
MATTISON

MACHINE WORKS

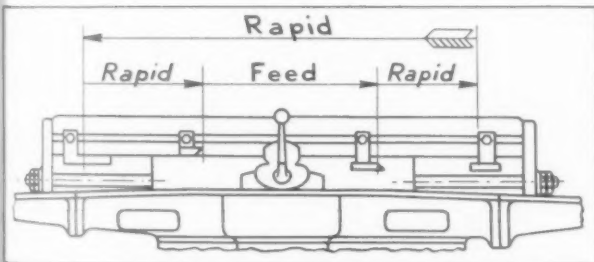
ROCKFORD • ILLINOIS

Engineered Production

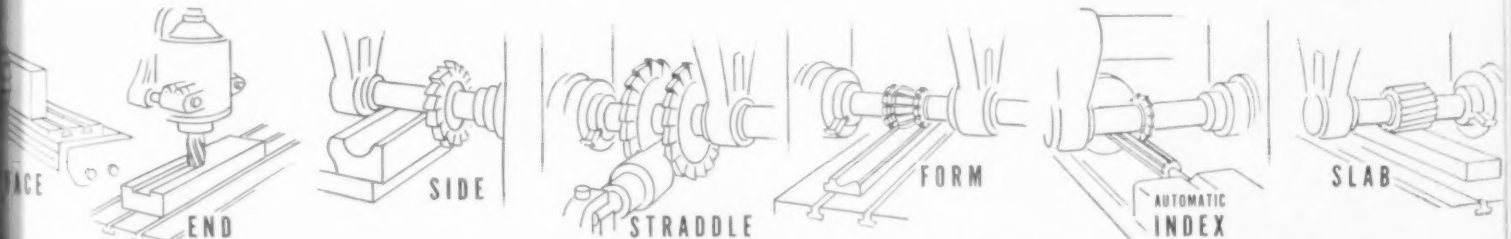
Do You Have Parts of Small Arms, Machine Guns, Bombs, Fuses, To Mill?



This picture, taken between shifts in a small-arms factory, shows some of the Sundstrand No. 0 Rigidmils used for a wide variety of milling operations on rapid-fire gun parts. Similar batteries of Rigidmils, and Sundstrand Automatic Lathes, are growing rapidly in United Nations munitions plants.



Unusual Rigidmil cycle above grooves brass pieces $1\frac{1}{2}$ " long at 1800 an hour. Others do milling operations sketched below in single, skip-stop or two-way set-ups.



On all types of milling operations for the class of work indicated, Sundstrand No. 0 Rigidmils and engineered production are giving remarkable speed, ease, and economy.

Fast—No. 0 Rigidmil speed begins with set-up. Spindle r.p.m., feed rate and operating cycle can be established very quickly. Convenient panel gives operator complete control of electric motors. After set-up, speed continues in operating cycles which include rapid traverse of 325" a minute.

Automatic—Simple, reliable, safeguarded; the automatic cycles of No. 0 Rigidmil provide maximum output with minimum operating effort and skill. Man, woman, boy, girl—almost anyone can attain peak productive operation quickly on a No. 0 Rigidmil, and keep it up steadily without excessive fatigue.

Hydraulic—Feeds for any material, kind of cut or cutter—any feed rate whatever throughout the wide range of the No. 0 Rigidmil—are secured by a simple adjustment. These, the 325" rapid traverse, the variety of cycles and their simple control are all provided by Sundstrand patented hydraulic equipment.

Versatile—High production and accuracy on various types and combinations of milling operations can be maintained easily on the No. 0 Rigidmil. High-ratio, 48 to 1, spindle head provides speeds from 25 r.p.m. to 2400 r.p.m. in two ranges, with 61 possible changes in each range. A half-dozen standard table-control dogs suffice for setting up the most frequently used cycles; a few specials meet the unusual conditions.

To Help You Mill More—Sundstrand Engineered Production Service gives you the benefit of priceless data files and practical experience on thousands of milling jobs, helps you solve new and unusual milling problems. Use this service freely. Send data for production proposals, without cost or obligation.

Get These Bulletins

Interesting Sundstrand publications shown above give information about No. 0 Rigidmils; the smaller No. 00; the larger No. 1; and spindle speeds for materials ranging from steel to magnesium. All four sent promptly on request for Bulletins 802.



SUNDSTRAND MACHINE TOOL CO.

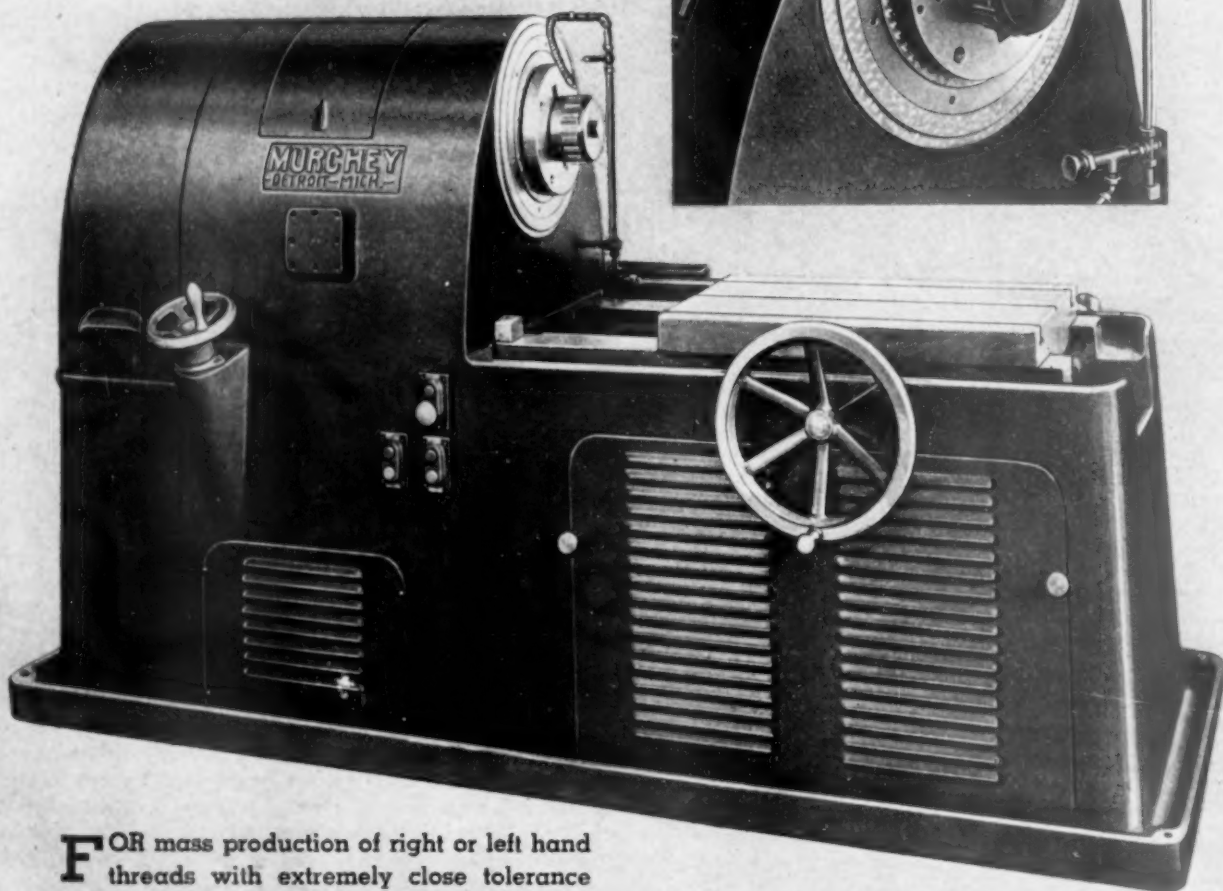
2532 ELEVENTH STREET, ROCKFORD, ILLINOIS, U. S. A.

Announcing

A NEW THREAD MILLING MACHINE

THE *Murchey*

#42



FOR mass production of right or left hand threads with extremely close tolerance and absolute concentricity, internal or external from 4" to 12" dia. x 3" long by means of annular milling cutters covering the full length of thread.

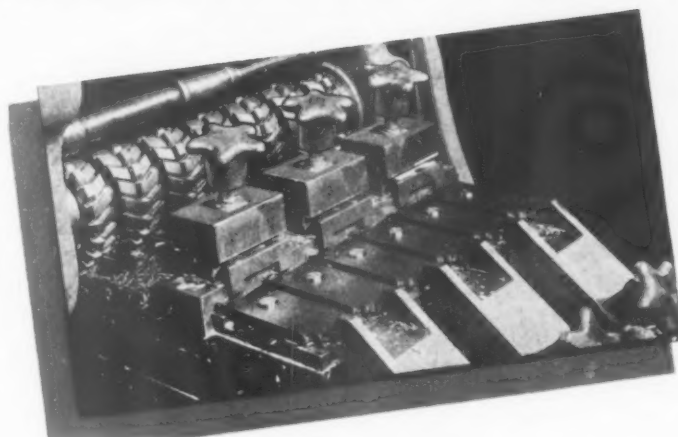
The work table is quickly moved up to a stop after which the work remains stationary. The hob revolves on its own axis at 33 to 645 r.p.m., and also moves eccentrically 1.2 revolutions around the work for each threading

operation. The "throw" of the eccentric is adjustable up to $\frac{3}{4}$ ".

A hardened and ground lead screw imparts a forward motion to the eccentric spindle to produce an accurate pitch of thread. Here is a machine with automatic threading cycle that will solve many of your precision, large diameter threading problems.

Delivery from Stock

MURCHEY MACHINE & TOOL COMPANY
DETROIT, MICHIGAN



*L*ITERALLY snatching an enemy bomber out of the sky requires the utmost marksmanship of which men and guns are capable. Much depends upon the gun.

Much depends, also, on the tools that make the gun. National Cutting Tools are tools of character, built for hard use, long life, exacting precision.

NATIONAL

TWIST DRILL AND TOOL COMPANY



TWIST DRILLS
REAMERS, ROSS
MILLING CUTTERS
COUNTERBORERS
SPECIAL TOOLS

HOME OFFICE AND FACTORY—DETROIT, MICH.

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

HAND STONING ELIMINATED ON CHAMBER REAMERS...



...ONE OF SEVERAL USED IN SEQUENCE
IN THE MANUFACTURE OF GUN BARRELS



**B-C CHAMBER REAMERS GIVE MUCH
LONGER TOOL LIFE, AND SHARPENING
IS REDUCED TO A FRACTION OF FORMER
TIME BY A SPECIAL FIXTURE ON THE
B-C COMBINATION SHARPENING MACHINE**

CONVENTIONALLY, reamers of this type are ground and hand stoned, an operation requiring several hours, and the irregularities of this method result in a comparatively short cutting life, per grind, for the reamer. By the Barber-Colman method, chamber reamers can be completely sharpened in approximately 30 minutes with such accuracy and uniformity that production per sharpening is increased from 200 to 300%. In one instance, the elimination of hand stoning released five skilled men for other vital work. . . . Furthermore, the positive cam control of the B-C Combination Sharpening Machine assures extreme accuracy in the maintenance of closely held tapers and diameters which characterize this type of reamer, and any reamer which may be "off" on profile or parallelism is automatically corrected in the sharpening.

**B-C REAMERS PRODUCE
A FINE, SMOOTH FINISH
FREE FROM RINGS OR WELTS**

THE cartridge chamber in a gun barrel must be perfectly smooth and free from any surfaced irregularities, because the firing of the driving charge puts a tremendous expansion force on the cartridge case. If this case should be forced into rings or welts on the chamber surface, serious difficulties in ejecting the shell will result, and smooth operation of the gun will be greatly impaired.

Chambering operations on a gun barrel are usually accomplished by a series of reamers; roughing, semi-finishing and finishing. These reamers must necessarily be made to extremely close tolerances on certain tapers and diameters in order to produce a chamber into which the cartridge will fit properly, and must produce, throughout the chamber, the fine finish described above.

Barber-Colman cartridge chamber reamers achieve these desired results, due to manufacturing methods which insure close tolerances, parallelism of flutes, correct tapers, and extremely close control of minute cutting clearances. These reamers produce chambers which are accurate in every critical dimension, with a surface finish which is entirely free from scratches, rings, or welts. Most important, this accuracy can be uniformly duplicated by resharpening on the Barber-Colman Combination Sharpening Machine with the special fixture illustrated above.

**LET OUR ENGINEERS
MAKE RECOMMENDA-
TIONS TO SOLVE
YOUR REAMING
PROBLEMS...**

BARBER-COLMAN COMPANY

General Offices and Plant 213 Loomis Street, Rockford, Illinois, U. S. A.



PRODUCTS

MILLING CUTTERS,
HOB, HOBGING
MACHINES, HOB
SHARPENING MA-
CHINES, REAMERS,
REAMER SHARP-
ENING MACHINES,
SPECIAL TOOLS

BARNES
BETTER *Metal Cutting*
Hack and Band
SAWS



**"YES SIR! WE MEN WHO USE
 THEM KNOW THEY'RE BETTER!"**

They know from actual experience! They know that the consistent record for accuracy, high production and long life that is part of every Barnes Blade is no mere accident. It is the result of careful manufacture by an organization devoted to making metal cutting blades exclusively for over twenty-three years. Barnes Blades have honestly earned this splendid reputation and will continue to merit the confidence of the men who use them, the men who "know they're Better".

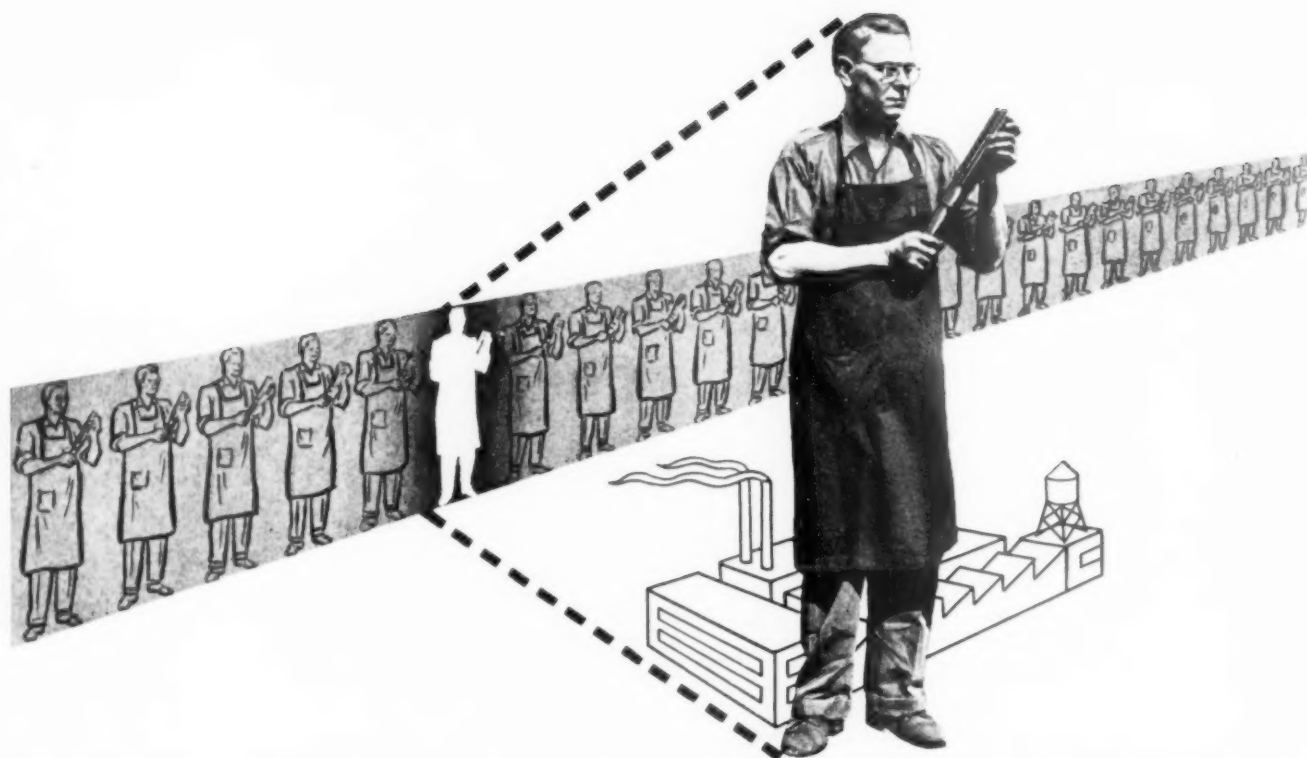
Buy Barnes Blades Through
 Your Mill Supply Distributor



"BETTER HACK SAW
 BLADES SINCE 1919"

W. O. BARNES CO., INC.

1297 Terminal Avenue, DETROIT, MICHIGAN



"25 Tool Makers Needed for Every 1 Available!"

There's a mighty tough training job to be done, and it must be done quickly!

You can train *more* tool makers *faster* by taking advantage of Carpenter's program of *All Aid to Tool Steel Users*. It is a program backed by years of research and experience with tool steel and tool steel problems. In many tool rooms, Carpenter is helping to answer such common questions as *How to eliminate grinding checks?*, *How to design for longer tool life?*, *How to make tools that wear longer?*

The foundation of this program is "Tool Steel Simplified," a 315-page illustrated handbook... written in

shop language. Easy to understand, it helps each tool maker and apprentice apply its practical working information to his particular problems. The chapter on *Trouble Shooting* is particularly valuable in training tool makers.

Over 25,000 copies of this handbook are at work in industry now, simplifying apprentice training and helping to get *more output from each pound of tool steel*. "Tool Steel Simplified" is available at cost—\$1.00—to tool steel users in the U. S. A. (\$3.50 elsewhere). After you have read it, you will see why more of your men should have copies of this useful handbook.

THE CARPENTER STEEL CO., Dept. 41, READING, PA.



Use "Tool Steel Simplified" as your training assistant... and remember that your nearby Carpenter representative and our Metallurgical Department can provide real help to enable you to solve new tool making problems.

"Tool Steel Simplified" is available at cost—\$1.00—to tool steel users in the U. S. A. (\$3.50 elsewhere). 315 pages, 205 illustrations. Send for your copy today.





FEDERAL SHELL GAGES

Shells, give them more — but accurate ones. Help make sure that every shell goes true to its mark by precision inspection.

CONCENTRICITY INSPECTION:—Shells whose diameters are all concentric will not wobble off their course. And, a Federal Concentricity Gage will inspect both inside and outside diameters *simultaneously*.

DIAMETER INSPECTION: — Any number of outside diameters can be inspected *independently* of each other yet *simultaneously* on a Federal Diameter Gage.

No shell is true unless it is inspected for Concentricity and also for Diameter. They are two *different* types of inspection. Write for Shell Dial Indicator Gage folder.

FEDERAL PRODUCTS CORPORATION
1144 EDDY STREET
PROVIDENCE, R. I.

Diameter

Concentricity

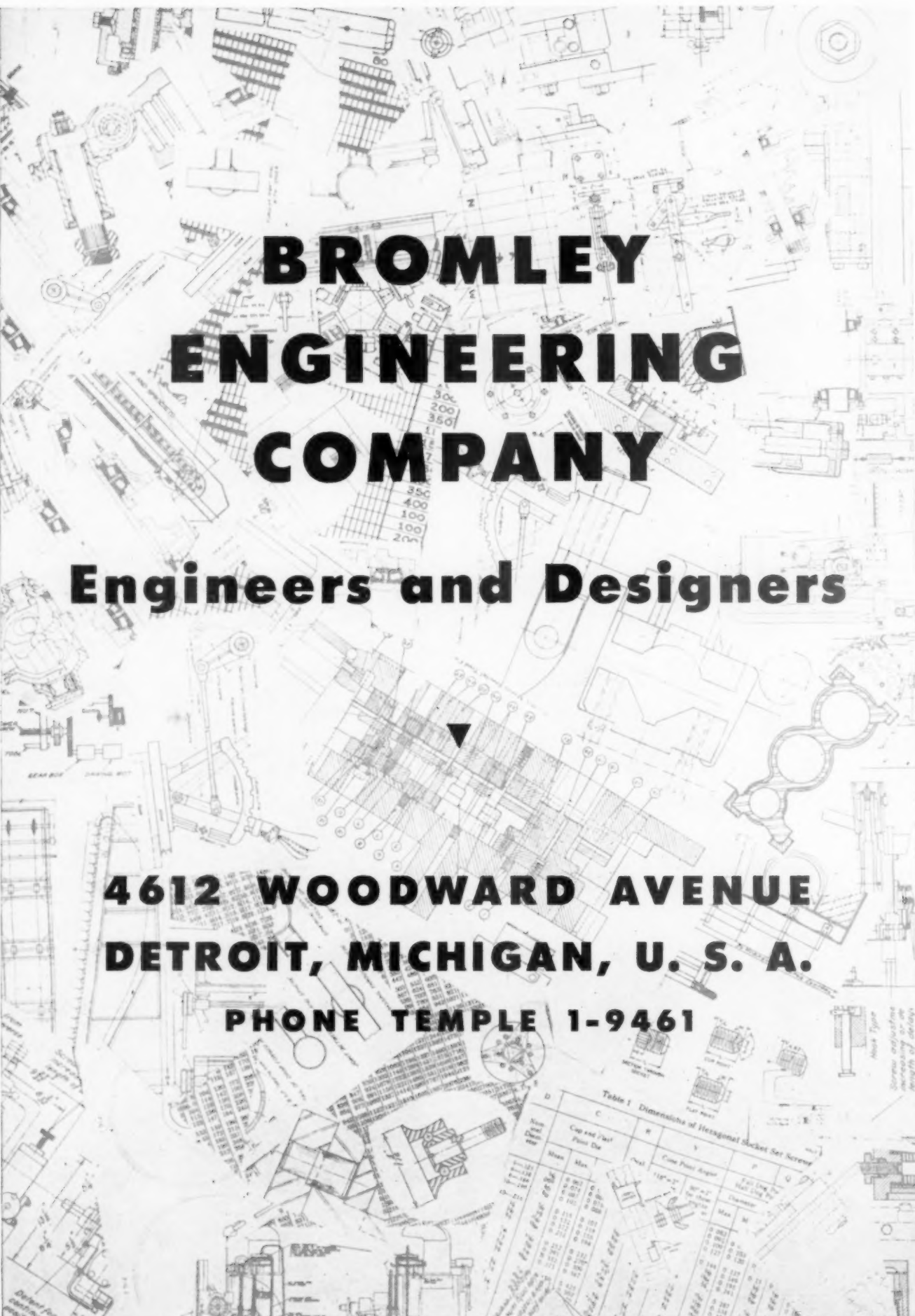
Diameter

**Fast and
Accurate
Simultaneous
Inspection**

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BROMLEY ENGINEERING COMPANY

Engineers and Designers

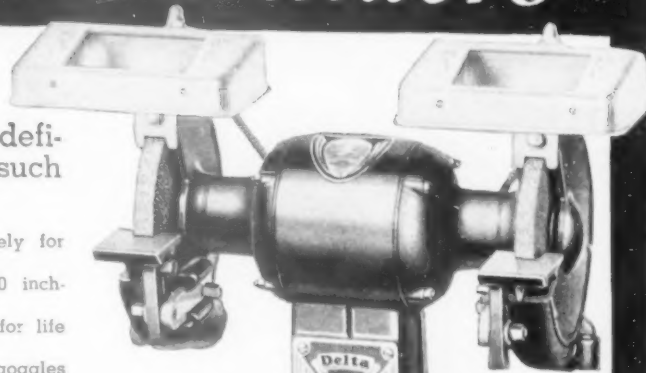
**4612 WOODWARD AVENUE
DETROIT, MICHIGAN, U. S. A.**

PHONE TEMPLE 1-9461

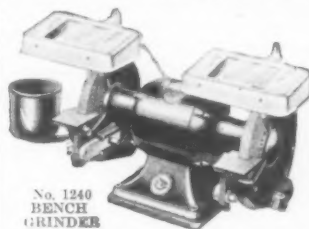
Here's why shops *busy on the armament program* insist on *Delta Grinders*

SHOPS that need more grinders to speed up war production, know definitely that Delta grinders offer such specific advantages as:

1. Special motors designed and balanced exclusively for Delta grinders.
2. Grinder wheels dynamically balanced to 1/100 inch-ounce.
3. Double sealed-for-life ball bearings—lubricated for life—sealed against grit.
4. Twin-Lite Safety Shield—eliminates need for goggles—provides illumination on both sides and face of wheels.
5. Fully machined, easily adjustable tool rest—rigidly mounted adequate guards.



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No. 1240
BENCH
GRINDER

Built in both single phase and three phase models, bench and pedestal types, there is a Delta grinder to fit every shop. The motor-driven bench grinder also incorporates all of the

latest Delta design and construction features . . . Twin Lite Safety Shields . . . double seal New Departure ball bearings . . . strong and efficient wheel and spark guards . . . absolute freedom from vibration (due to especially balanced Aluminous Oxide wheels).

Send for Catalog

Send coupon below for Delta Catalog giving full details and specifications on the complete line of Delta grinders.



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GRINDER

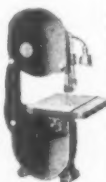
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A complete line of single and multiple spindle 14" and 17" drill presses in slow and high speed models.

METAL CUTTING BAND SAW

Cuts almost anything in metals and plastics from jig and fixture bases 1 1/2" by 2" thick to draw die segments 6" thick.



OUT-OFF MACHINE



Cuts speedily and to exact lengths a wide variety of materials. Priced at one-half the usual cost of machines of this type.

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DELTA
Production
TOOLS

The Delta Manufacturing Company
610-8 E. Vienna Avenue, Milwaukee, Wis.
Please send me your special Grinder Bulletin giving full details and specifications on the complete line of Delta Grinders. ☐ Also send me your latest Delta catalog of industrial power tools.

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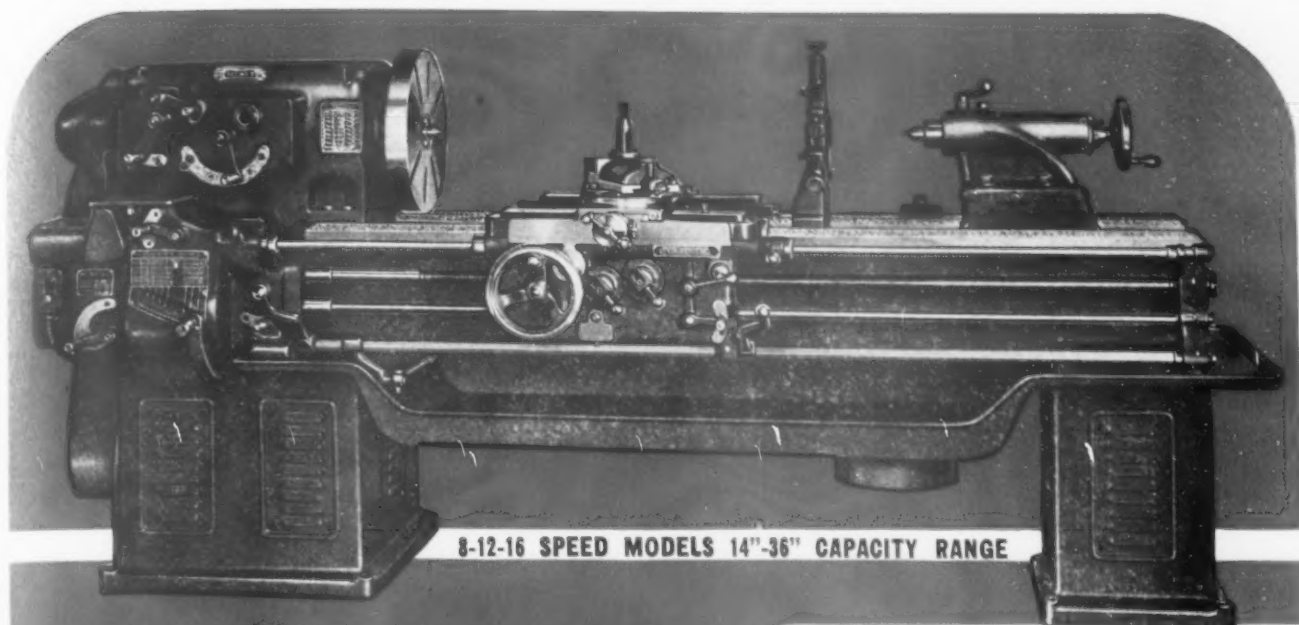
EXTRA HEAVY DUTY MULTI-OPERATION DRILLING AND BORING MACHINE

Adaptation of Standard Baker Units to multi-roughing operations in the cross bore of propeller hubs. The hubs are solid forgings of tough material, requiring rigidity and power. Five operations are performed, one hub at each machine cycle. The machine has a six station index table, allowing one station for chucking. Main drive and Oilgear pump drives give a total of 90 hp.

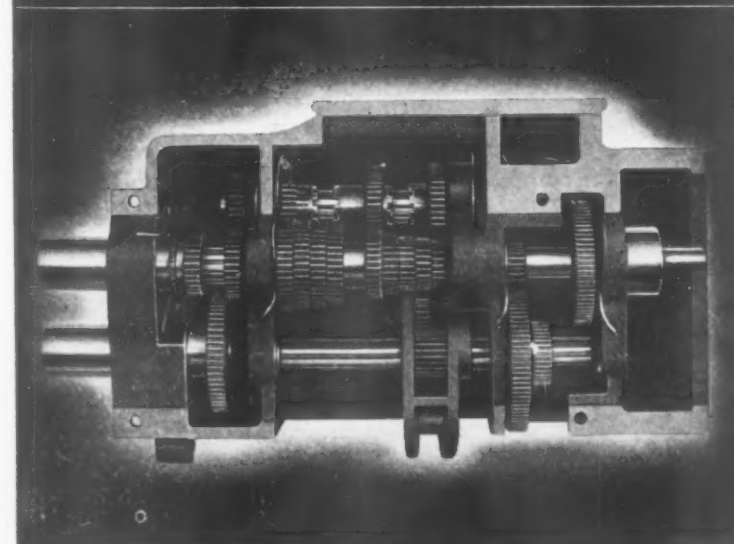
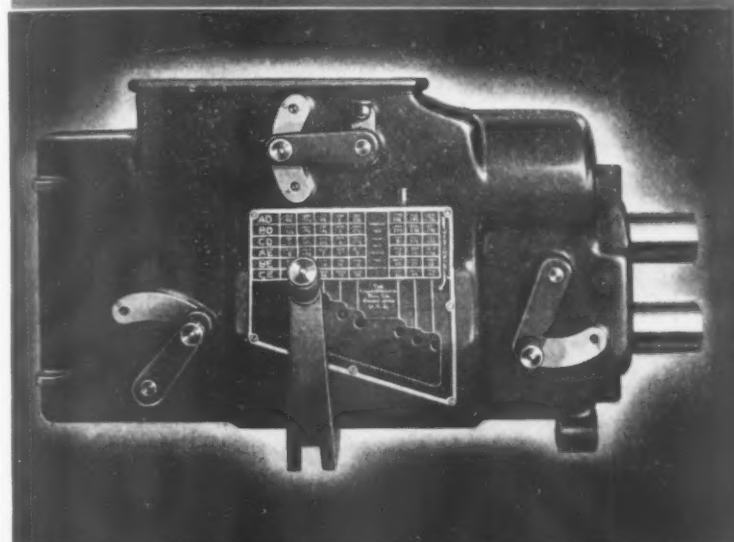
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BAKER BROTHERS, INC. TOLEDO, OHIO, U. S. A.

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8-12-16 SPEED MODELS 14"-36" CAPACITY RANGE



**DESIGNED FOR SPEED
BUILT TO LAST**

***Sidney
Lathes***

Sidney Lathes—14" to 36" capacity range—are designed to give the utmost of production—the greatest possible versatility—and long, trouble-free life. Sidney Lathes have the stamina to stand up under the unusual production of war time demands and stay on the job for years.

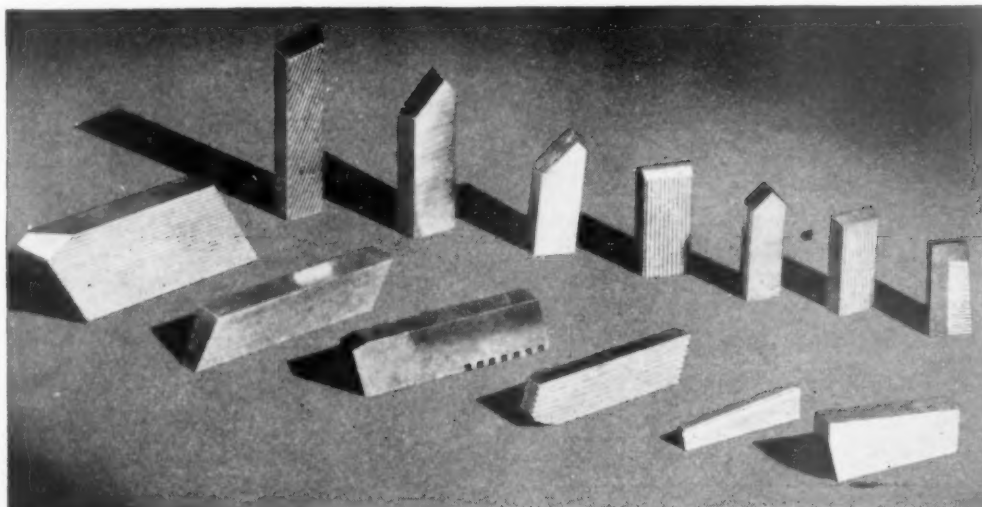
GEAR BOX

The Gear Combinations illustrated provide a range of 48 selective thread and feed changes. All shafts are mounted on anti-friction bearings and both shafts and gears are made of alloy steel, heat treated and hardened.

**Complete bulletins on all models
quickly available.**

SIDNEY
MACHINE TOOL COMPANY
SIDNEY . . . OHIO . . . U. S. A.

For Economical Production USE HAYNES STELLITE TOOLS



Haynes Stellite Special Milling Cutter Blades

Shown above is a group of Haynes Stellite special milling cutter blades, typical of the many Haynes Stellite special tools which are available. Other special tools which are regularly cast and finish ground to users' specifications include blades for boring and reaming, form tools, spot facers, welded tip tools, counterbores, reamers, and brazed-in-blade milling cutters.

Wide Range of Tool Applications

Haynes Stellite alloy tools are economical because these uniform, dependable tools operate at high speeds with long life between grinds—at a low cost per piece machined. These tools are used for machining practically all machinable materials, except chilled cast iron and manganese steel. Specific operations include turning, facing, boring, reaming, milling, grooving, cutting off, forming, spot facing, core drilling, and counterboring.

Standard Tools Stocked for Immediate Delivery

1. Solid Tool Bits—Wide range of square and flat sizes.
2. Welded Tip Tools—Large variety of styles and sizes.
3. Milling Cutter Blades—Various types for many cutter bodies.

* * *


Write or phone the district office nearest you for complete information on standard and special Haynes Stellite tools.



Red hard, wear-resisting alloys of cobalt, chromium and tungsten

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y.  Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.



Our Advertisement Published In

Heald Service

The Way It Looks To Us

We believe that a manufacturer's service to his customer does not begin with simply manufacturing a certain type of machine, which he may design on rather general lines, nor stop with the mere selling of the machine and shipment from the factory.

The best results can only be obtained when the manufacturer and the customer work in full co-operation with each other.

With this end in view we have built up the HEALD SERVICE, whereby we can assist those who have bought HEALD MACHINES by adapting the machines to their work, and suggesting labor and time-saving devices through the careful study of our engineers.

To those confronted with grinding problems we can, therefore, offer the benefit of our large experience in grinding, and this department is at their disposal for advice and assistance if in any way our machines are adaptable for their work.

Note What This Means To You

It means that we want to assist you in every way possible to derive the greatest efficiency from Heald Machines.

Our experts are ready to take up your problems, study conditions, and work out with you the solution of these problems in connection with our machines through the knowledge we have gained from large experience in the use of grinding machines.

We invite those who are troubled with grinding problems to send us blueprints, or better still, samples of work, which may be the means of this department giving you helpful suggestions as to methods or ways of handling work, and in that way we may be able to assist you in getting the best possible output and quality, as your problems are very often similar to problems that have been solved by us in other shops and for other people.

This service becomes more valuable to you the more closely you are willing to work with us along these lines, and we trust that you will have no hesitation in calling on us at any time.

The Heald Machine Company
10 New Bond Street, Worcester, Mass.

1911

WHAT WE SAID

31 YEARS AGO

IS TRUER THAN

EVER TODAY

IN YOUR AREA

Today we have facilities, experience, equipment and personnel undreamed of in 1911 and yet it is all yours for the asking. We have established service offices in the following cities where a phone call will get you immediate attention.

CITY	PHONE
Chicago . . .	State 6856
Cleveland . . .	Cherry 2049
Dayton . . .	Fulton 4109
Detroit . . .	Madison 5060
Indianapolis . . .	Lincoln 6478
Lansing . . .	2-0805
New York . . .	Barclay 7-4318
Rochester . . .	Main 3479
Worcester . . .	5-3191



BOUT of the O'TOOLS

10 ROUNDS —
AIR VS. HIGH-CYCLE
GRINDERS

ROUND 5—A "SET-UP" FOR HIGH-CYCLE!

Job: Production grinding in a steel mill. Needed more portable tools so they called in the *Rotor Analyst*. Air supply was low. The *Rotor Analyst* demonstrated HIGH-CYCLE tools and compared performance and costs with AIR tools. Rotor HIGH-CYCLE grinders won the decision on these points:



1. 25% faster metal removal is obtained on this job with HIGH-CYCLE tools.
2. First cost lower by \$791. AIR tools would have required new compressor, costing about \$1488. MG set for HIGH-CYCLE cost only \$697.
3. Power costs lower by \$500 yearly. MG set for HIGH-CYCLE required 16.8 K.W. less power than a compressor for AIR.
4. 25% longer wheel life resulted with the HIGH-CYCLE grinders.

THE ROTOR ANALYST GOES "ALL-OUT" FOR OUTPUT!

Want faster production from your existing AIR or HIGH-CYCLE installation? Want to add to your present capacity and keep the investment cost below par? Want to cut down on repair periods?

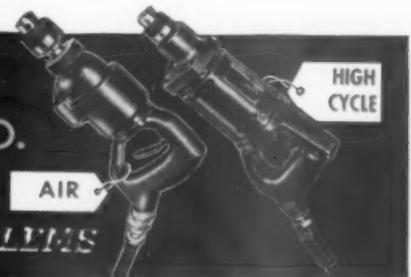
The *Rotor Analyst* tackles and licks problems like this every day. He can go "all-out" for results because he's unbiased—for AIR or HIGH-CYCLE. Call him in and get his recommendations. No obligation.

The *Rotor Analyst* has 65 different Air tools and 59 different High-Cycle tools with which to solve your problems.

THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



A New Steel *Perfected*—

Just when You Need it Most!

INGERSOLL D-B-L* HACK SAW STEEL

* Produced under exclusive
license arrangement with
Allegheny-Ludlum Steel
Corporation

Other Special INGERSOLL Sheet Steels include:

Alloy Steels
Armor Plate
Clutch Plate Steels
Tillage Steels
Soft Center Steels
Shovel Steels
Knife Steels
TEM-CROSS Steel
Ingaclad (Stainless-
Clad Steel)
Stainless Steels and
Saw Steels, including
"18-4-1" and Molyb-
denum and D-B-L
Hack Saw Steels.

Faced with the biggest job it has ever known, American Industry welcomes the timely development of Ingersoll D-B-L.

With 18-4-1 restricted by the shortage of vital alloys, the problem of supplying hack saw blades that would meet every shop need became a serious one.

Ingersoll D-B-L is so high in impact resistance, provides so tough a cutting edge, and is relatively so free from decarburization, that when these advantages are added to its lower cost, there is every reason to believe Ingersoll D-B-L has found a permanent place in the modern shop.

Here is one substitute developed by necessity which may well become the prime metal for future hack saw blade use.

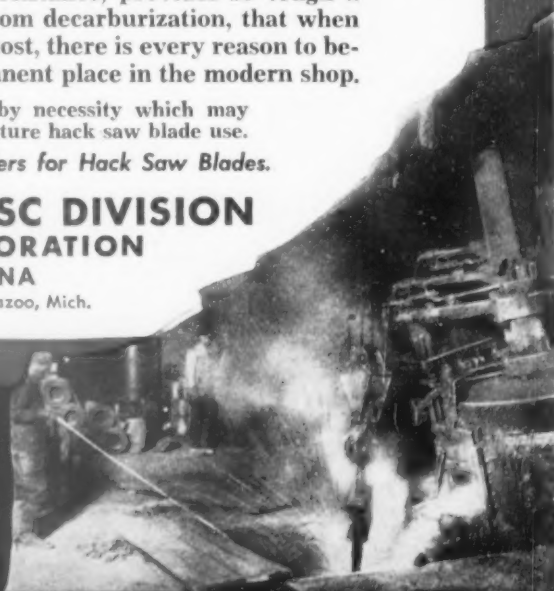
Specify Ingersoll D-B-L Steel on orders for Hack Saw Blades.

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
NEW CASTLE, INDIANA

Plants: New Castle, Ind.; Chicago, Ill.; Kalamazoo, Mich.

INGERSOLL

SPECIAL STEELS for SPECIAL USES



NEW! SMALLEST IMPACT TYPE PNEUMATIC WRENCH



↑ ONLY 5 1/2" LONG, weighing only 2 pounds, Chicago Pneumatic 337-RS is the smallest impact type pneumatic wrench. Speeds production on jobs like this 3/4" nut-running on an airplane wing section.

FOR FAST WORK in hard-to-get-at places — there's a 45° model of this new wrench — CP 337-RAF. Note how easy it is to reach the 1/4" nuts on this wing section. →



FAST APPLICATION AND REMOVAL OF NUTS UP TO 1/4" BOLT SIZE

Speeds Up Assembly or Knock-Down Jobs

NEW YORK (CP) — Chicago Pneumatic Tool Company, manufacturers of the largest line of impact type pneumatic wrenches, announces the development of the smallest pneumatic wrench — the CP 337-R. This midget among wrenches was designed especially for driving elastic stop nuts; the angle types for hard-to-get-at places. It greatly speeds the application or removal of nuts up to 1/4" bolt size. Small enough to hold in the palm of the hand and lighter than any pneumatic wrench heretofore available, the new CP 337-R fits in perfectly with the growing trend to the employment of women in industry. Write for complete data on the 337-R and other CP wrenches.

CHICAGO PNEUMATIC
TOOL COMPANY

General Offices: 8 E. 44th St., New York, N. Y.



↑ APPLYING 3 NUTS PER POST, 24 posts, on an assembly job in a fraction of the time required to do the work with a manual type wrench. Note convenience of the right angle drive of the CP 337-RAN—handles nuts to 1/4" bolt size.

CHICAGO



PNEUMATIC

PNEUMATIC TOOLS

ALSO: Air Compressors, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

WRENCHES
DRILLS
REAMERS
RIVETERS
CHIPPERS
GRINDERS

In 3 months one large
 manufacturer buys supplies made
 by 145

different manufacturers . . from one
 local Supply Distributor, who
 delivers every item from stock

How are You buying Your Materials?

A prominent Mill-Supply Distributor writes:—"Our big, all-time job is to help War Plants who are our customers to produce faster—by keeping them furnished with equipment and supplies on schedule.

"Just how the Manufacturer can profit by the Jobber's alert, fast-moving service in his behalf is illustrated in the experience of one of our own customers—a Manufacturer we have served for many years. We analyzed our transactions during a typical 3-month period and dug up these impressive facts:—

A—"Materials supplied by us to fill his orders during that 90-day period were produced in 145 different factories.

B—"Goods from these 145 factories were ordered and paid for by us, and came directly to our warehouse stock.

C—"Deliveries from our warehouse to this customer were nearly always made the same day we received his order."

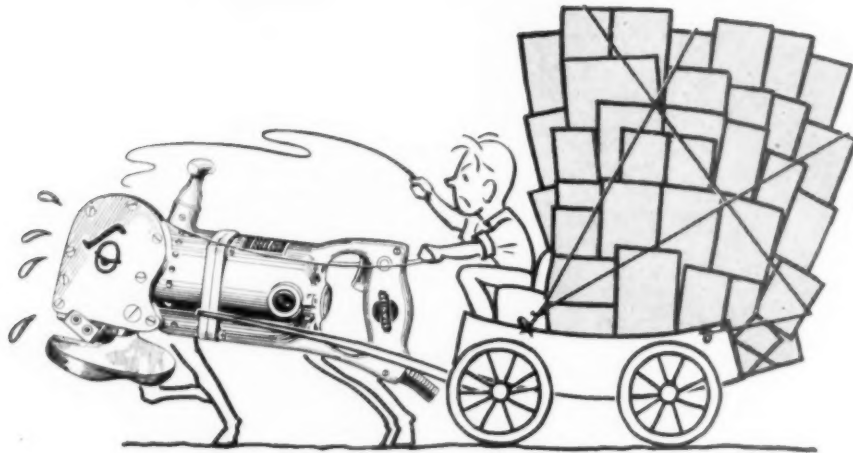
Depend on it—your Industrial Distributor will use every resource to supply what *you* need. He works in your interest all the time—as we know, because Mill Supply Houses have represented us in selling "Cleveland" High-Speed Twist Drills and Peerless High-Speed Reamers nationwide, for many years.

The **CLEVELAND** TWIST DRILL
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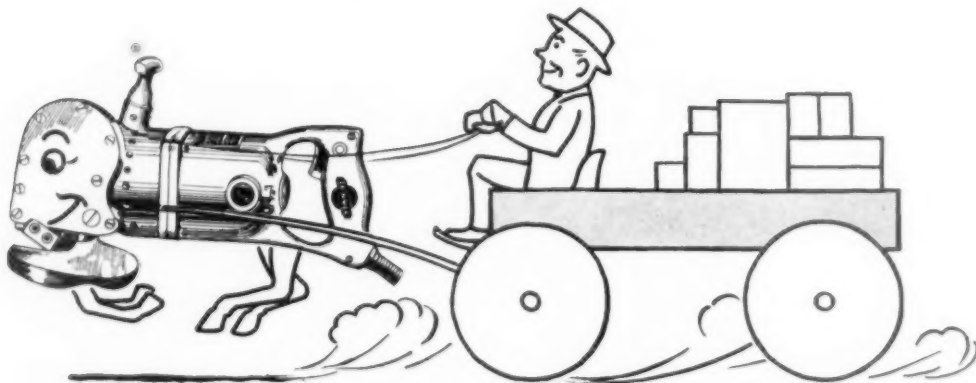


"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Portable Electric Tools are Hard to Replace



Overloading Risks Trouble—Shortens Service Life



Treat 'em Right and Keep 'em on the Job!

STANLEY ELECTRIC TOOLS are designed and built to last a long time. You can get this long service, — so necessary in the present emergency, — and save money on repairs, if you follow the simple instructions for maintenance packed with the tool. We'll gladly send new instructions if you need them.

If parts wear out, don't discard the tool. Have it repaired or rebuilt. Stanley is maintaining its usual repair service, and keeping replacement parts available for prompt delivery. Stanley Electric Tool Division, The Stanley Works, New Britain, Conn.

DON'T OVERLOAD

Use a Unishear of the proper capacity for the material to be cut. The rated capacity is printed on the name plate attached to each Unishear.

Most overloading is caused by dull blades, which put a strain on the motor and produce poor cuts. A Unishear will cut faster, use less current, and operate more smoothly if blades are kept properly sharpened at all times. A little time out for sharpening saves a lot of time and trouble on the job.

TOOLS
THE WORKER'S
WEAPONS IN
TOTAL WAR

STANLEY
Electric Tools



SYMBOL OF DEPENDABLE PERFORMANCE IN TOOL STEELS



Coppco water hardening (gray label) and oil hardening (black label) tool steels have been developed from the long experience of our metallurgical engineers and their familiarity with the users' requirements.

"COPPCO .75"

WATER HARDENING **GRAY** LABEL

Hardens to give greater toughness than Coppco Universal or Coppco 1.10. *Used for:* Shock tools · Extra Large Shear Blades · Swages · Button Sets · Drift Pins · Cold Chisels · Large Hammer Dies · Rivet Busters · Sledges.

"COPPCO UNIVERSAL"

WATER HARDENING **GRAY** LABEL

Balanced hardness and toughness. Good cold cutting properties. *Used for:* Pneumatic Tools · Large Shear Blades · Punches · Mandrels · Blacksmith Tools · Arbors · Vise Jaws · Dies—*Cold Heading, Trimmer, Heavy Stamping, Drawing, Forming, etc.*

"COPPCO 1.10"

WATER HARDENING **GRAY** LABEL

Gives maximum hardness. Holds a keen cutting edge. Resists wear. *Used for:* Milling Cutters · Circular Cutters · Woodworking Tools · Fine Shear Blades · Knives · Drills · Arbors · Reamers · Dies—*Embossing, Jewelers, Cold Heading, Threading, etc.*

"COPPCO 200"

OIL HARDENING **BLACK** LABEL

Non-deforming. Deep-hardening. Wear resistant. *Used for:* Broaches · Milling Cutters · Threading and Tapping Tools · Reamers · Precision Tools · Gauges · Dies—*Blanking, Forming, Extrusion, Stamping, Shearing, Trimming, etc.*

"COPPCO" TOOL STEELS ARE ONE OF THE FAMILY



OF ARISTOLOY "SPECIAL QUALITY" STEELS

COPPERWELD STEEL COMPANY WARREN, OHIO

Keep 'em Cutting!



with a

SELLERS Heavy Duty TOOL GRINDER

Sellers No. 5T and 6T Tool Grinder grinds any cemented carbide or high speed steel, straight or convex curved face tools, including thread tools of any angle of thread or pitch, internal or external, and will accurately reproduce the desired angles and clearances on all the tools. It handles all sizes of tools and tool bits from $\frac{1}{4}$ " up to the maximum size of the chuck used, 2" x $2\frac{1}{2}$ " or 3" x 3" square.

This machine does all the work necessary to finish to shape from either forged or bar stock cutting tools for lathes, planers, boring mills, etc., making it possible to maintain, ready for use, a full supply of such tools. It effects savings in tools by removing the minimum amount of tool material, in production costs by producing the exact shapes required to maintain high cutting speeds, and in grinding time, by more rapid shaping and sharpening.

It is also applicable for grinding double end cutters for boring bars, fly cutters, inserted teeth for heavy saws, rock drill bits, round punches, chisels, oil grooving gouges, etc., by means of special chucks or holders.

Write for bulletin or special information

WILLIAM SELLERS & CO., Inc. • 1600 Hamilton St. • Philadelphia, Pa.



Sellers



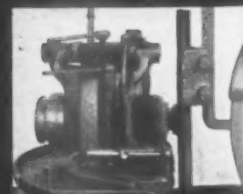
Grinding the left side face of a thread tool of great pitch.



Grinding the left side face of a large V-tool.



Grinding a circular tool.



Supplemental chuck as used for the end face of a hook tool.



Setting a curved face tool by this index.



Metal facts...Organized *for Production Victories*

American industry...in the rush of converting its plants to war production...needs much new information about alloys. Such information...detailing the selection, fabrication and uses of ferrous and non-ferrous Nickel alloys...is available promptly from our files of technical reports and shop guides.

And, as further support in the battle of production, we offer the assistance of our

engineering staff and field service men. Their recent experiences in many plants, their practical knowledge of ways to overcome shortages of materials, makes them especially helpful during wartime.

Nickel...and information about Nickel...goes wherever they best speed Victory.

Nickel

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET
NEW YORK, N. Y.

AIR HAMMER *Pistons*



Air hammer piston on left is made of Graph-Tung Steel. After 5,280 hours, it showed little sign of wear. The hammer on the right, made of ordinary tool steel, failed after 546 hours.



Several years ago we made 25 air hammer pistons of Graph-Tung Steel. When one of these, operating at 2,500 strokes per minute, achieved a record of 5,280 hours of service we were so well pleased that we ran an advertisement telling all about it.

We thought then and we still think our enthusiasm was well founded because companion pistons made of standard tool steels stood up under the same service conditions a maximum of 546 hours.

Here's the sequel to this story. These 25 Graph-Tung Steel pistons averaged 7,680 hours of service life.

The less expensive Graph-Mo Steel is now being widely used with similar results.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

TIMKEN
TRADE MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

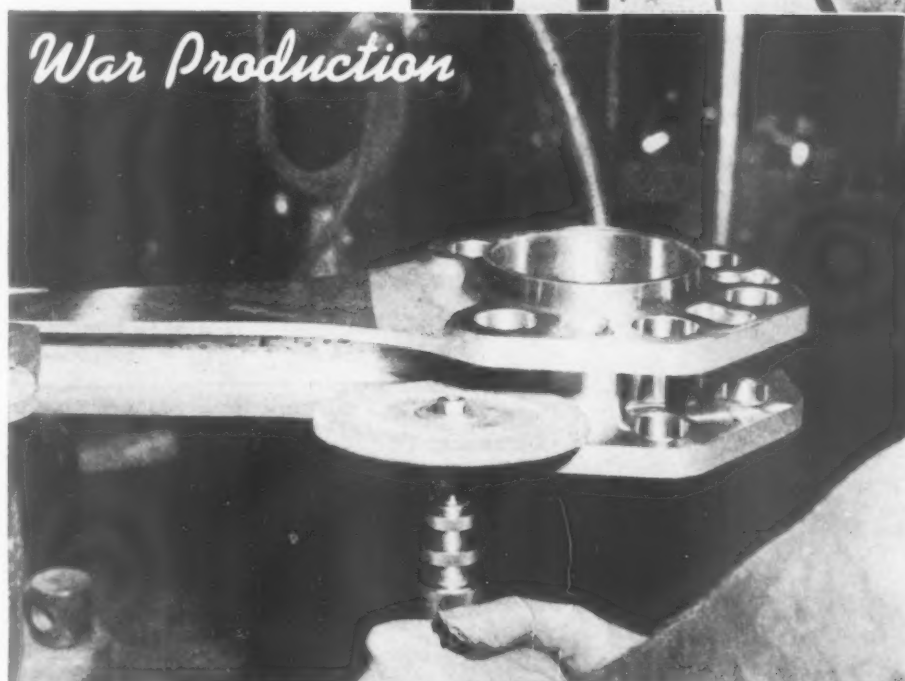
You **SAVE** steel
and **SPEED** up produc-
tion with Graphitic Steels.
Long service and high speeds
are essential to **VICTORY**.
They'll be essential in
post-war competi-
tion, too.

Jarvis

POWER TOOLS

Sanding and finishing ornamental bronze. Photo courtesy of

General Bronze Corp.
New York



Finishing aircraft engine master rod. Photo courtesy of

Wright Airo. Corp.

THE CHARLES L. JARVIS COMPANY

TAPPING ATTACHMENTS



FLEXIBLE SHAFT MACHINES



GROUND ROTARY FILES

Middletown, Conn.

JULY, 1942

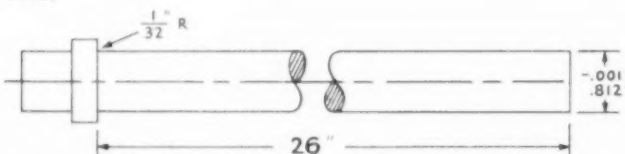
61

A Lesson in CYLINDRICAL GRINDING

How to grind a relatively long and slender annealed steel shaft straight and round to a high grade finish and up to a shoulder at one end.

Equipment

Norton 6" x 30" or 10" x 36" Type C Plain Cylindrical Grinder, 24" x 3" x 12" 50-L5BE Alundum wheel for rough grinding and 3880-J5BE Alundum wheel for finish grinding, three steadyrest, 1" micrometer.



Operation No. 1

Mount the work in the grinding machine.

1. Wipe the center holes clean. Remove any burrs either with a three cornered scraper or on a center hole lapping machine.
2. Inspect the work centers; regrind them if scored.
3. Position the headstock and footstock on the table so that the work comes approximately over the center of the table.
4. Clamp a driving dog on the shoulder end of the piece and lubricate the center holes with red or white lead, mixed with oil. Fig. 1.
5. Mount the work between centers and adjust the driving pin in the face plate so that it strikes the dog squarely. Adjust the footstock so that the work turns with a snug running fit.

Operation No. 2

Dress the 50-L5BE Alundum wheel coarse for fast cutting.

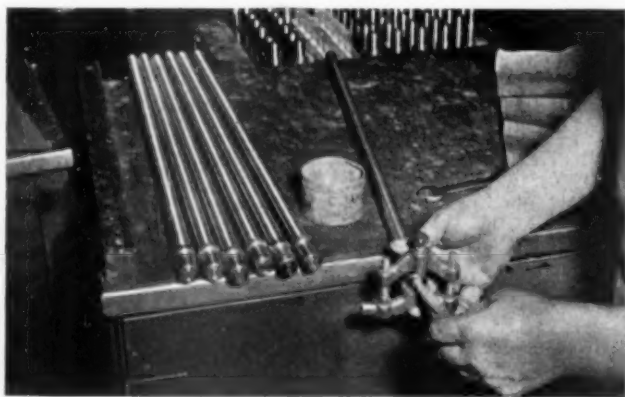


Fig. 1. Lubricate center holes in work.



Fig. 2. Use full flow of coolant in truing.

1. Position the diamond tool in the holder so that it has a minimum amount of overhang and the nib is at an angle to the grinding wheel face in the direction of wheel rotation. Clamp the diamond tool firmly. A loose diamond or diamond tool will cause chatter marks on the work surface.
2. Turn on the coolant and feed the wheel into the diamond about .001" per pass. Fig. 2. Use a medium table traverse. Take only enough passes to dress the wheel coarse. Excessive dressing wastes both wheel and diamond.

Operation No. 3

Rough grind the .812" diameter to .814".

1. Space the three steadyrests equally along the work. Judgment and experience rather than any fixed rule govern the number of steadyrests to use for a given part. Do not immediately adjust the steadyrests.
2. Measure the work to determine how much stock has been left for grinding.
3. Advance the wheel to the work at the footstock end until sparks are just seen. Set index against stop. Then measure the work. Similarly, advance the wheel to the work at the headstock end to the same index setting. Measure the work at this end. If the diameters are not exactly the same, swivel the table a proportionate amount in the right direction so that the work will be ground straight.
4. Spot grind the work opposite one of the steadyrests until a steady and uniform stream of sparks indi-

ates the work is running true. Fig. 3. Then bring the lower shoe of the steadyrest firmly against the work. With the other hand adjust the front shoe so that it rests lightly but snugly against the work.

5. Similarly, spot grind opposite the other two steadyrests, adjusting the shoes as just described.
6. Plunge cut grind the .812" diameter next to the shoulder to within .002" or .003" of the rough grind size. Fig. 4. "Bump" the shoulder with the side of the wheel to just clean.
7. Set the table dogs so that the table reverses within $\frac{3}{4}$ " of the shoulder and overlaps the footstock end of the work about $\frac{1}{3}$ of the wheel face.
8. Rough grind the .812" diameter to .814". Use the fastest work speed, a fast table traverse and a wheel

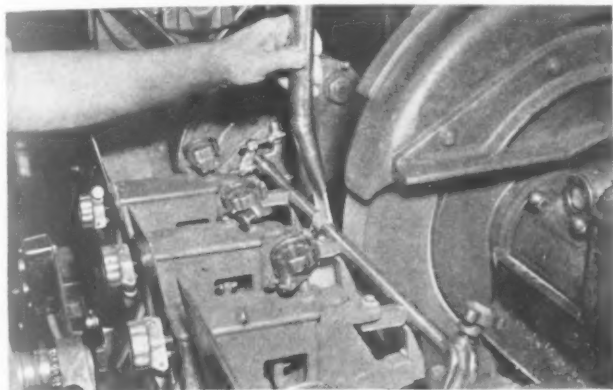


Fig. 3. Spot grind opposite each steadyrest.

feed of no more than .0005" per pass to avoid springing the work. Use plenty of coolant. This is important. Carefully adjust each steadyrest as the work passes it. Fig. 5. Be careful not to take up too much on the front shoe of the middle steadyrest as this would force the work toward the wheel, causing the work to be ground smaller at that point. Too much pressure on the bottom shoe will raise the center of the work, with the result it will be ground oversize. Release the steadyrest shoes before mounting each piece but do not disturb their setting after rough grinding the last piece and checking it to be sure it is straight within .002".

9. Redress the grinding wheel coarse as necessary, possibly every four to six pieces, to insure perfectly round work. A dull wheel will cause the work to come out of round.

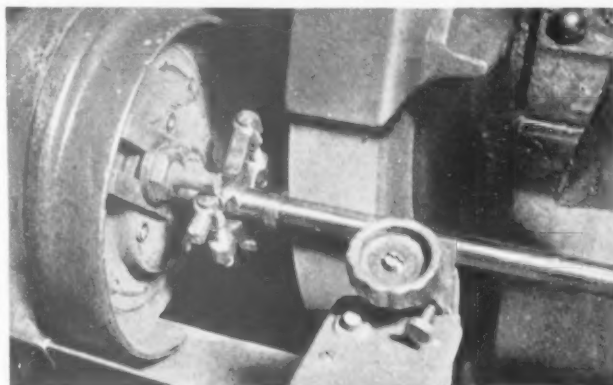


Fig. 4. Plunge cut grind at shoulder.

Operation No. 4

After rough grinding the entire lot of pieces, finish grind the .812" diameter to blueprint limits.

1. Remove the 50-L5BE Alundum roughing wheel and replace it with the 3880-J5BE Alundum finishing wheel. Dress the wheel fine, using the slowest table traverse and reducing the cut from .001" to none whatsoever on the last pass or two.
2. With a very light wheel feed, not exceeding .0003" per pass, and a medium table traverse, take a sufficient number of passes to bring the work down to finished size. Do not disturb the steadyrests during this finish grinding operation, provided the pieces are being ground straight and round. Check the work for size at each end and between the steadyrests.

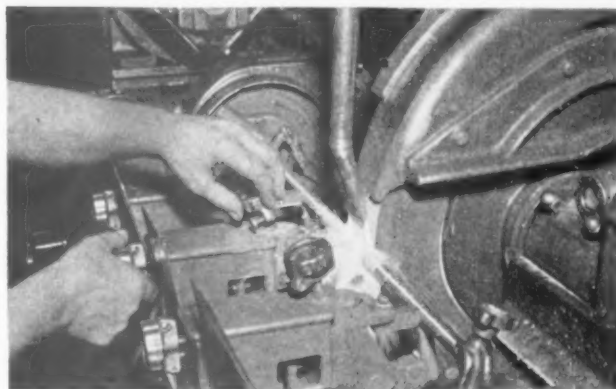
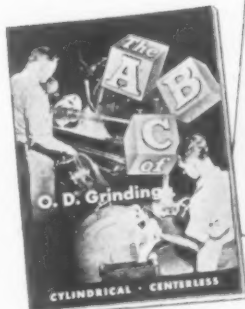


Fig. 5. Adjust steady rests carefully.

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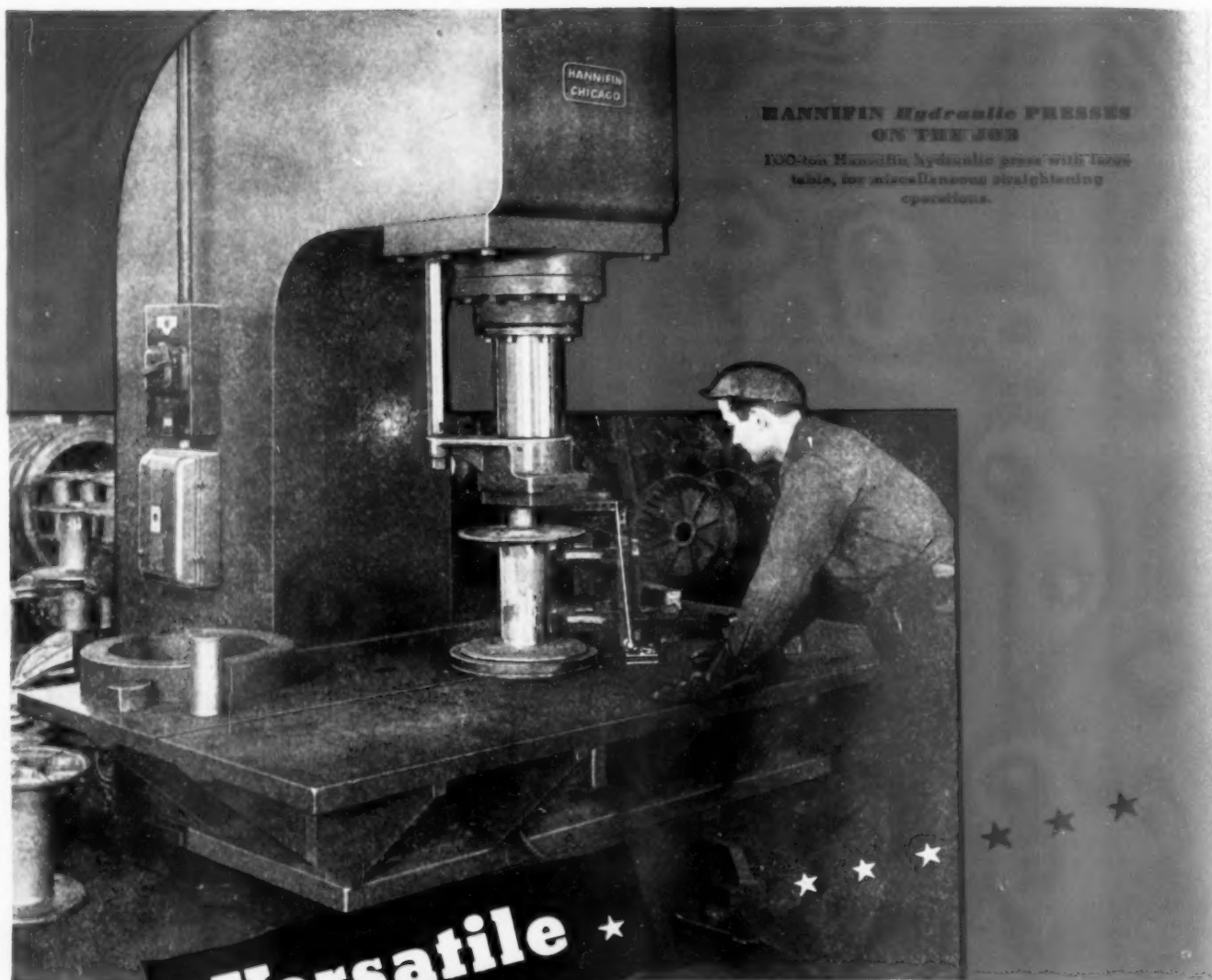


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THE TOOL ENGINEER

T.M. Reg. U.S. Pat. Office

JULY, 1942

Volume XI, Number 7

Fifty to One - - -

IT is estimated that, for every Tool Engineer and tool designer, there exists a need for fifty. Sizeable odds, aren't they 50 to 1? Yet, we'll give fifty to one that these odds will be overcome and the job done in time and *on* time.

We are fully aware that the fate of civilization rests squarely on the shoulders of the Tool Engineers of America. On their ability to invent, design, plan and put into execution, we will produce the requisite guns, tanks, ships and planes; instead of "too little and too late", we will be there *justest* with the *mostest*.

For a long time, the science of mass production has been developing and flourishing in this great country. Out of this has evolved a separate and distinct branch of the engineering profession which has singularly made us the greatest production nation on earth.

Tool Engineers, hard boiled, hard bitten and shop-trained the hard way—because that was the only means of training—are today performing, not only the herculean task of tooling for war production, but are increasing their numbers thru new and intensive training measures. While we concede that a Tool Engineer cannot be made overnight, there are many "comers" and "cubs" ready and eager for advanced training; these young men, with the necessary stuff between and above their ears, are qualifying under the tutelage of experienced men.

THE 50 to 1 ratio may be disputed. Let it suffice to say that, 'til victory is achieved, the demand will be much greater than the supply. But, we have a great advantage in that, as a nation, we are years ahead of the Axis powers in tooling and manufacturing technique, a fact borne out by inducements to American Tool Engineers, in '37, to go to Germany to tool refrigerators and "volks-wagons".

Today, we can, will and doubtless are out-producing the Axis powers in essential war materials. The 11,000 members of the American Society of Tool Engineers comprise an army of manufacturing talent of which the world has not seen the

equal. The phenomenal growth of the Society, in ten years, with fifty-four Chapters throughout industrial America, attests to the aggressiveness and alertness of Tool Engineers.

This same spirit, cultivated by long experience in wrestling with tough production and tooling problems, of reducing costs and meeting deadlines, makes this war production job old stuff to this *branch of the service*. Nevertheless, there exists the opportunity, the challenge and the patriotic responsibility for every Tool Engineer, not only to burn the midnight oil, but to extend and multiply his effectiveness by aggressive and determined assistance to indispensable training programs. And, entirely in addition to this extra job is yet another—that of consultation.

There are many plants, both small and large, now engaged in the manufacture of items entirely foreign to previous experience, whose managements are greatly handicapped by a lack of Tool Engineering knowledge. But, in the membership of the local or nearby A.S.T.E. Chapter, there will be found the experience and engineering brains capable of solving any production or tooling problem.

The formal form of this consultation service is taking definite shape. As American citizens, as the guiding geniuses directing the production the men behind the men who man the guns, the Tool Engineers are assisting in this essential consultation in many ways.

TODAY we are not a nation of competing industrial enterprises; we are a united industrial body working for a common cause. As a unit in this body, the American Society of Tool Engineers, to its last member, thru its national and chapter committees, thru its journal—THE TOOL ENGINEER—which you are reading, is equal to the task of the hour. It will meet the challenge, will cancel out the odds of 50 to 1.

O. W. Winter

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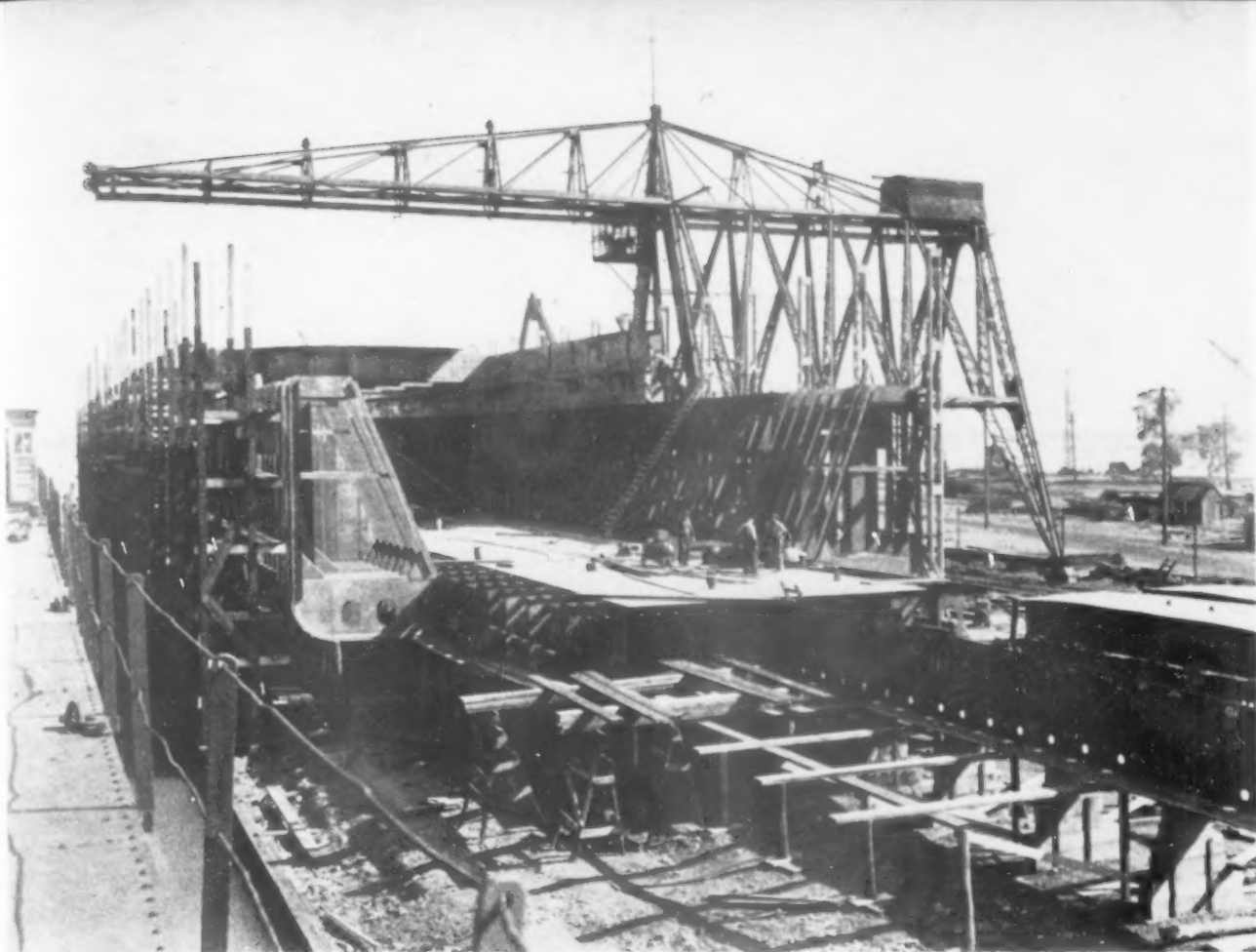
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General view of partially constructed hull where prefabricated arches weighing 20-tons are erected on the deck of the ship. Stimulated by war-time demands, the shipbuilding industry is now utilizing Tool Engineering.

Great Lakes Shipbuilding

New Methods and New Tools Speed The Job



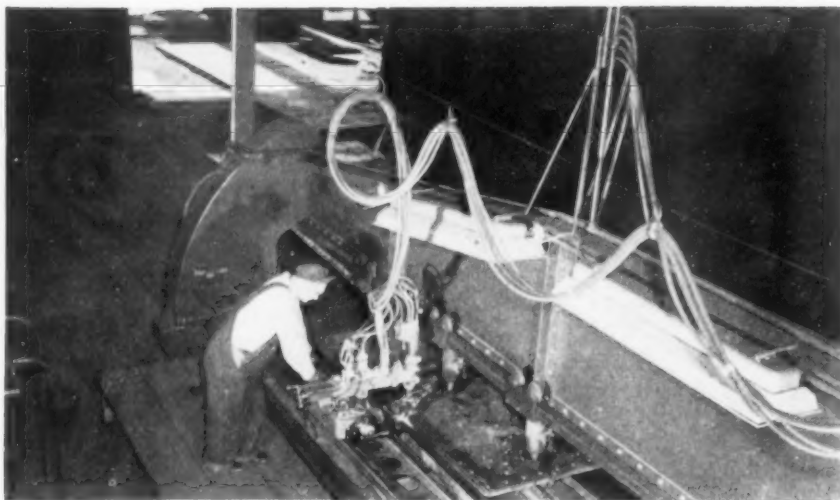
To meet war production demands, another 600-foot lake freighter is launched.
JULY, 1942

J. M. Scotten.

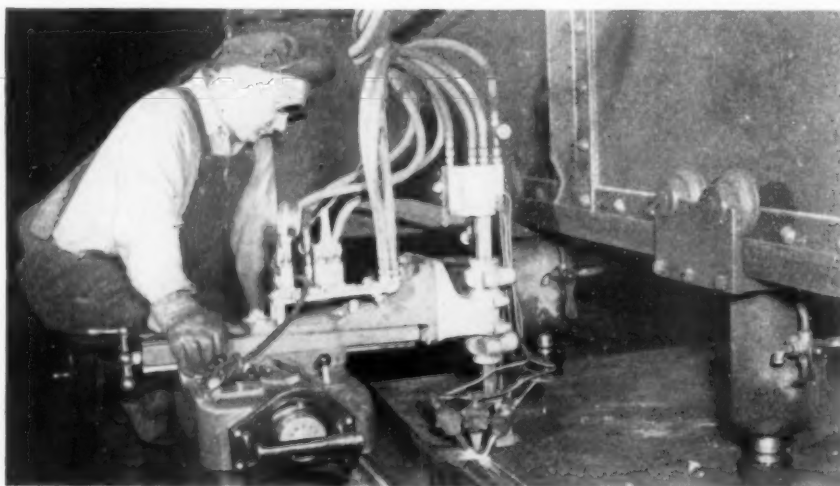
Great Lakes Engineering Works
River Rouge, Michigan

STEEL is the basis of the entire war production program of the United States. Without steel America can't build tanks, guns, airplanes, battleships or vessels to transport troops and war materiel needed to achieve victory on world-wide battlefronts.

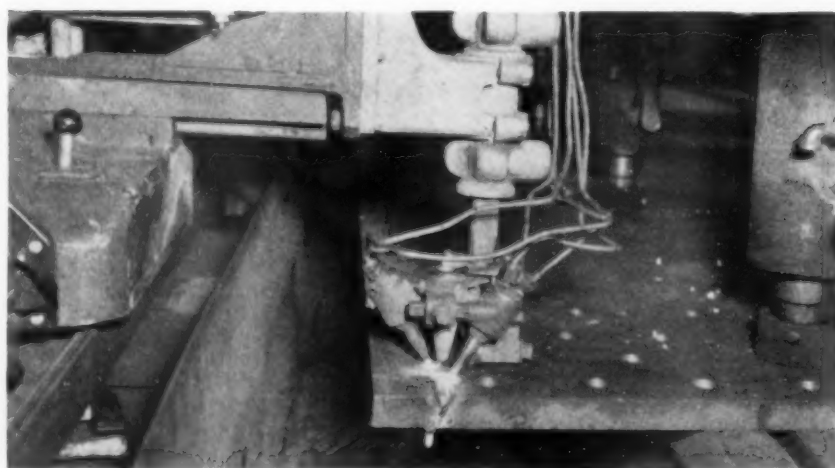
Before you make steel, you must have iron ore. Because of the unchallenged economy of water transportation, the majority of iron ore has long been moved on water from Minnesota's great Mesabi Range at the



War demands for speed in production have stimulated the ingenuity of Great Lakes shipbuilders. Among the new tools they have built in their own shops is this flame cutting edge preparation machine.



Because one concern was unable to obtain rapidly new tools necessary to speed production, it converted a mechanical plate planer into this new machine for cutting a double bevel and land on 55-pound plate.



With three flame cutters automatically moving down parallel edges, hull plates are cut to exact size and double beveled for electric welding. No layout work, handling or turning of the plate is necessary.

head of the Great Lakes to the steel mills at the lower lake ports.

Last year, which witnessed the commencement of the Lend Lease program, 84,000,000 tons of iron ore were moved on the Great Lakes, exceeding any previous nine-months navigation season in history. To meet the mounting demands of the national war production program, the OPM has demanded that more than 100,000,000 tons of ore be transported during the 1942 navigation season.

Seemingly impossible of fulfillment, this transportation problem will be met by commissioning many new freight ships during the next few months. By year's end, keels for more than 20 mammoth ore carriers will be laid in American shipyards on the Lakes.

Six hundred feet long, built to peculiarly American design, sailed in a tradition of their own, these freighters are among the most functional ships afloat. Their advantage over other forms of transportation in carrying ore to the mighty maws of American steel mills lies mostly in their 18,000 ton capacity. The ore carried down the lakes in only one such ship would fill 360 standard railroad freight cars.

Great Lakes freighters are now born in the heat of oxy-acetylene flame and machine welding — with considerable savings in time and labor. Partly pre-fabricated in the shops, their parts are cut and put together with new speed, new accuracy, and greater facility.

Foremost, the pressing demand for more bottoms on the Lakes, has led to the discarding of the slow, tedious mechanical means of preparing steel plates for erection on the berth, and the adoption of flame cutting for plate edge preparation.

It has also eliminated the use of much riveted construction. In most work on heavy steel framing and plating, the rattle of the riveter's hammer has given way to the brilliant welding flame.

These processes have been carried beyond the actual fabrication of the hulls so that hundreds of shell attachments, fittings and supplementary parts of lake vessels are now manufactured by the use of these processes.

To appreciate the significance of these new methods, an explanation of earlier methods is necessary. When the marine architect released the

ship's design, full-sized patterns were laid out on what was known as the mold-loft floor. From these, wood templates were cut to the full dimensions of each hull part. The shape of every steel plate in the entire hull was reproduced in wood. From the loft, the shipfitter took the templates to the yard where plates were sheared and planed to size. If the plates were to be welded, they had to be beveled. This required a third machining operation.

The inability to obtain rapidly the equipment necessary to put this program in operation has stimulated the ingenuity of Lake shipbuilders, and has produced many novel and interesting conversions of machine tools to flame cutting.



Beveled plate is shown here in position for machine welding on deck of boat.

One interesting example of this is the conversion of a mechanical plate planer to a flame-cutting plate-edge preparation machine.

Machines have been built by shipbuilders in their own shops for the simultaneous preparation of two or more edges of a plate. These machines eliminate a vast amount of work which was necessary under earlier shipbuilding methods.

On one piece of equipment heavy steel plates are unloaded directly from railroad freight cars, and landed on the table of a machine where all edges of the plate are cut to size and double beveled for electric welding without previous layout work — or additional handling or turning of the plate.

When plates leave this machine, they are ready to be moved to the building berth for erection.

Thus, the principles of Tool Engineering have been applied to eliminate the mold loft — as earth-shaking

Tool Engineering . . . The Keystone In War Production

From a talk by Commander G. H. Bowman, U. S. N.

This is a grim war for us . . . Let's awake to the fact that in the first month of the war, there were more Navy men killed than in the Spanish-American and World Wars combined. This is war at home as well as war in the Pacific or on the Russian Frontier. Yours is the war of production . . . and in this highly mechanized age, it is a war of mechanical perfection. You, the Tool Engineers, are among the most vital and important fighters in that great unarmed force, the force of production.

Your Navy is dependent upon you . . . you men who lay the structure for all productive effort . . . you men who must provide tools and necessary equipment; design the tools that will make the 160,000 different items the Navy requires; layout complete operations for plants and carry the burden of conversion of peace-time commerce into war material centers of production. You are the keystone in the war production machine.

And it is necessary that we convert all possible peace-time commerce and industry into the channels of war-effort. We must convert every plowshare into a machine gun . . . convert cars into tanks; refrigerators into bomber turrets; and printing presses into shell stamping machines.

This tremendous amount of conversion is being expedited by the Tool Engineers of America. The Army and the Navy don't have time to determine what every plant can make. It depends upon the ingenuity of the Tool Engineer to get a plant ready for production. And on this ingenuity of the Tool Engineer rests the difference between victory and defeat!

It has been said that there are 52 jobs for every available Tool Engineer in war work today. Last year the machine tool industry produced over 800 million dollars worth of machine tools. This year they have set a goal of a billion and a half dollars . . . a goal, they must and will reach. The birthplace of the war production effort lies within the skill of the Tool Engineer. Our Navy, aside from its gallant crews, is said to be completely mechanized; and this machinery must be processed at some time or other by machinery designed by the Tool Engineer.

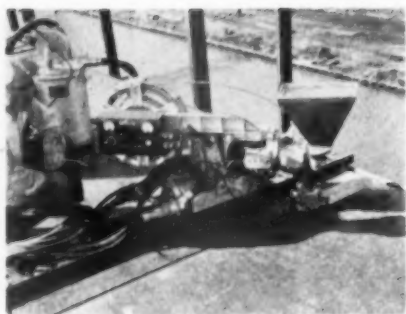
If the rate of production increase in shipbuilding is any criterion of the work of the Tool Engineer, these facts are significant. Recently a tanker was delivered in 100 days from laying of keel . . . a battleship will be delivered 14 months ahead of schedule . . . cargo ships are being built in less than one-half the time required in the First World War. This is a direct result of the effort of the Tool Engineer. And more ships means superior forces . . . and superior force plus our superbly trained Navy men will mean a quicker Victory!

The American fighting man is as good or as bad as his morale. And it is important to his morale that certain things be done for him. Give him the tools and he'll do the fighting.

Yours is the job of supplying the fighting power for what will be the largest single fleet ever afloat. When completed, we will have 700 vessels of war. I repeat those figures: 32 battleships . . . 19 aircraft carriers . . . 91 cruisers . . . 364 destroyers . . . and 186 submarines . . . !

This task cannot be completed, nor the task of our fighting men, without your aid . . . and your skilled ability on the home front! You have a tough job before you. You have heard of MM Day . . . The Mechanical Mobilization Day, on the last day of 1942, when our plants are to complete the President's 1942 production order . . . 20,000 anti-aircraft guns, one every half hour; 45 thousand tanks; that's one every 12 minutes, day and night; 60,000 planes, a plane every 8 minutes, day and night every day including Sundays and Holidays. Time is short!

It is your job, your fight, to devise methods of giving longer life to those tools that are forced to operate around the clock, day after day; to keep these same tools in peak performance and producing more and better war equipment. You must design machines that will continue to eliminate all possible chance of error that can mean death to our fighting sons!



Machine welding of 55-pound deck plate at the rate of eight inches per minute.

as taking the pattern shop out of the automobile plant. This application applied to hull construction, has resulted in 50 per cent time-saving and 80 per cent decrease in labor cost.

Two types of fixtures for flame-cutting have been developed that illustrate the basic simplicity of the idea. For shearing and beveling one edge of the plate, a horizontal planer has been converted for use as a flame-cutting fixture. The oxy-acetylene cutting head travels along the same edge as would the planing tool, tilted to the angle of the required bevel. The bevels and land are finished to required smoothness and tolerance. No machining is required.

Where four edges of a square plate are to be cut and beveled, a fixture has been devised for automatic operation of two flame-cutters. Two heads operated simultaneously travel down parallel sides of the plate. Speed of cutting and distance are automatically controlled.

At the building berth, plates are pre-fabricated into hull sections which are raised onto the ways and tacked by welding to the hull construction. Pre-fabrication, allowing welding on a horizontal plane is limited only by the crane capacity of the yard. Mass production is introduced on this welding to the extent that horizontal welding is simpler than welding on a vertical plane. It is a single type of operation more or less repeated over and over, by less skilled operators, and allows utilization of fast machine welding.

All work which can be done on a horizontal plane is done with the new Unionmelt automatic machine process (See Tool Engineer, May, 1942).

Welded hull sections include the $1\frac{1}{8}$ inch plate keel which is approximately 600 feet long, and the $11/16$ inch bottom plates and tank tops (see

drawing). Butt ends of side hull plates also are welded so that they form a continuous strake 600-feet long.

On the ways, bottom, and deck plates are welded on the hull construction by machine welding. Welding speed is approximately 12 inches per minute. About 900 Amperes are required. Machine welding is backed by hand weld from below.

A hydraulic joggling machine, utilizing 600-tons pressure, puts the necessary offset in the 12-inch channel frames for the hull so that the use of liners is eliminated. This is another of the machines that has been developed in Lake shipyards. Working against the strength of the vertical cross section of the beam, the press crunches down on the cold steel in two



The advantage of Great Lakes ore carriers lies in their 18,000-ton capacity.

slow, steady impacts, creating a jog of about an inch.

Ore carriers have from 15 to 30 hatches, openings for loading and unloading cargo. Hatch covers are welded from four sections of mild steel plate. A steel frame, contoured

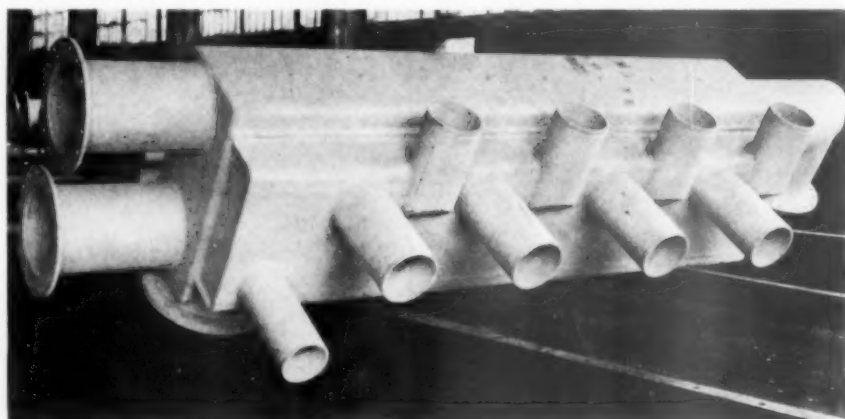
to the shape of the hatch cover is used as a welding jig. Plates laid on the jig automatically bend to its slight contour by their own weight. Welding fixes them to this shape. Forming a single hatch cover formerly required three or four days. The job is now accomplished in one day.

On much war production — tanks, planes, motors and guns — the trend has been to revert to casting from welding, with a saving of time, weight and metal. Shipyards have reversed this trend in the manufacture of sea cocks, overboard discharge valves, ballast manifolds and other attachments to the hull—with the same results. Ballast manifolds, about 24-feet long, four-feet high and four-feet wide, which help control the flow of water in the ballast tanks, were once expensive castings. Their expense was figured at more than simple cost per unit, because of the waste caused by occasional bad castings and costly foundry and machining overhead.

With almost every ship, slightly different hull or tank design necessitated a completely different mold for the casting.

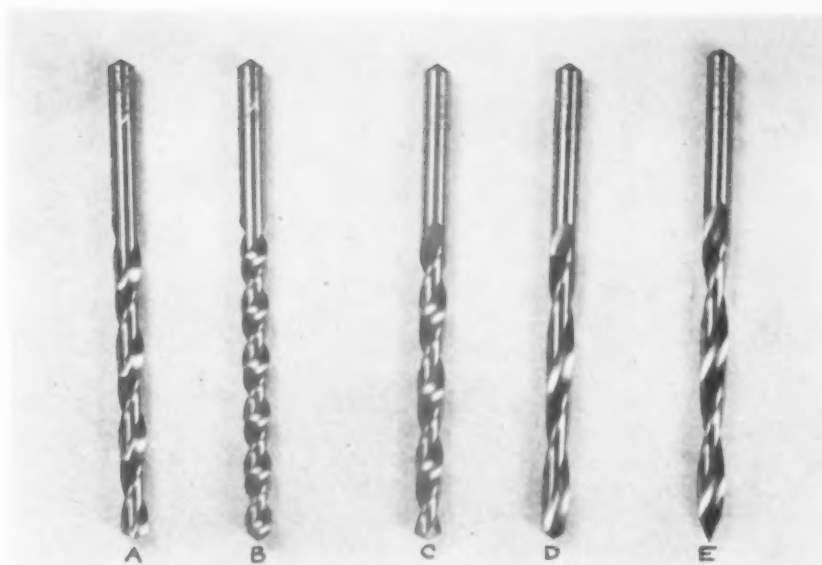
By welding these manifolds up from shape and plate, utilizing a jig which can be easily altered to accommodate various shaped manifolds, pattern work, molds for each manifold and wasted castings have been eliminated. Castings, after completion, often failed under hydraulic tests. The new manifolds not only stand the tests, but allow better flow of water because of the finer finished form and contour which can be achieved by welding.

* * *



Ballast manifolds, 24 feet long, four feet high and four feet wide, formerly were cast. By welding these manifolds up from shape and plate, utilizing a jig which can be altered to accommodate various shapes, pattern work, molds and wasted castings have been eliminated by shipyards on the Great Lakes.

Common standard drills show comparison between types most suited for magnesium alloys and others. "A" is a general purpose tool; "B", suited to deep-hole drilling of tough, hard materials, is closest to filling requirements for drilling magnesium alloys; "C" is a heavy duty tool, such as is used for drilling cotter pin holes; "D" is a screw machine drill for soft materials; and "E" is a "Bakelite drill", designed for molded plastics, hard rubber, wood, some aluminum alloys.



Drilling Magnesium Alloys

ROY R. HOEFER
National Twist Drill & Tool Co.

The widespread use of magnesium alloys in war production work has posed numerous machining problems. One of these is the drilling of this soft, combustible metal.

MOST pure metals are relatively soft and do not possess the strength and related properties suitable for structural uses. Magnesium is no different in this respect, and when considering the machinability of magnesium it must be kept in mind the form in which it is used, namely, magnesium alloys.

When confronted with the problem of drilling any of the magnesium alloys we must remember that properly sharpened drills will give the best results. Likewise drills, like all cutting tools, should be kept sharp at all times. It has been found that heat generated in machining magnesium alloys sometimes causes a fire to start with disastrous consequences. Also it is well known that a dull cutting tool will generate more heat through friction of the cut than will a tool that is sharp.

Since there is more magnesium al-

loy used in airplane motors than some of the other war equipments, practically all of the data given here comes from the experiences found in that class of work. From actual experience in this work we learn that a standard drill, such as is carried in the stocks of either the manufacturer or their distributors, will produce good holes in magnesium alloy castings or forgings. However, before using, a standard drill must be resharpened to an included point angle of 135° . Also, the drill should be given a lip clearance of from 15° to 20° . In addition the sharpening should be done with a fine grained abrasive wheel, to produce the smoothest finish possible.

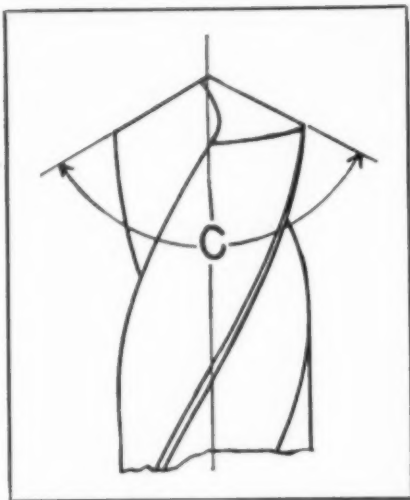
For production drilling in magnesium alloy castings or forgings, the standard or stock drill should be used for holes that are not more than twice the basic diameter in depth. In this material like most alloy steels we must consider any greater depth as deep hole drilling. Thus, for holes that do not exceed the depth mentioned, it will help high speed drilling if the drills have wide polished flutes.

When considering the production drilling of magnesium alloy castings

where the depth of the holes are more than twice the basic diameter of the drill it has been found that a drill having a faster spiral of flute facilitates chip disposal. Further, such a drill should have wide polished flutes. In addition it has been found that a drill having a margin about half the width of a standard drill helps reduce friction, also the clearance behind the drill margin should be about twice the depth of clearance provided on standard drills. Sharpening of such drills should be carried out as previously outlined. In addition it will be found that thinning the web of the drill at the point will reduce excessive heat generated by the cut. This point thinning also reduces the rake at the lip of the drill, and thus reduces the tendency to hook into the work.

Deep and Shallow Holes

By way of comparison between drills for shallow holes and deep holes in magnesium alloys it should be borne in mind that most standard drills have a spiral angle of flute of from 20° to 32° . Further, when reference is made to a fast spiral drill

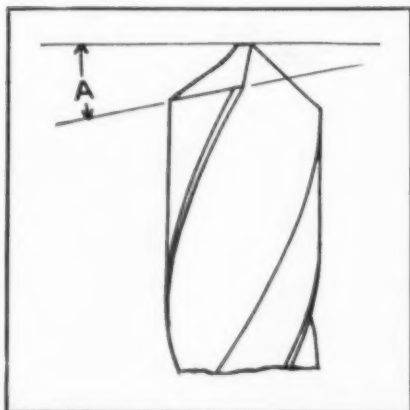


"C" on a standard drill should be re-sharpened to an included angle of 135° .

for deep holes, it is suggested that such drills have a spiral angle of from 35° to 40° . Experience has shown that such drills will drill holes six times the drill diameter, in depth without necessitating withdrawal of the drill to clear the chips.

The foregoing data will be found useful when drilling holes up to $1\frac{1}{2}$ inches in diameter. When considering the drilling of deep holes of a larger diameter in magnesium alloy castings or forgings, the flat or spade type of drill, with proper pointing and rake relief may prove quite satisfactory.

Many times the question is asked, can the hole size be held when drilling magnesium alloys. Experience and tests have shown that holes drilled in magnesium alloy castings and forgings are smaller than the actual diameter of the drill at its point by as much as .002-inch in some cases. Thus it



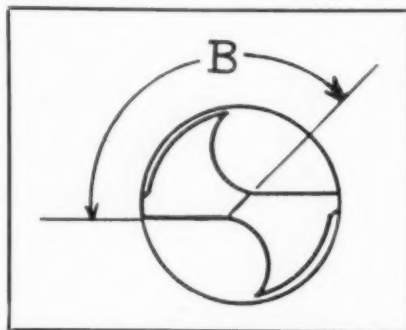
"A", the angle of lip clearance, should be from 15° to 20° . Sharpening should be done with a fine grained wheel to produce the smoothest finish possible.

has been found possible to drill a hole $\frac{1}{2}$ -inch diameter if the drill is about .001-inch over the basic drill diameter.

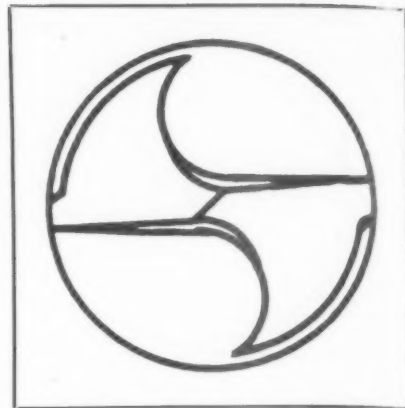
Oil Type Coolant

Next factor to consider in the drilling of magnesium alloys is the coolant or cutting compound. Under no circumstances should you use the soluble oils mixed with water, as the water will cause fires to start among the chips. Best results will be obtained by using an oil type of coolant. This can be kerosene, or any of the reputable paraffin base or mineral seal oils can be successfully used.

As a further word of caution it should be remembered that your drill manufacturer will be able to help you with specific data for any particular drilling job, and one should consult them when drilling any of the magnesium alloys.



Angle "B" is widened in proportion to the increase of lip clearance at the periphery of the drill. On magnesium drilling it may be as much as 135° to 140° .



Thinning of the web, wide, polished flutes, and a faster spiral angle—from 35° to 40° —is recommended.

Drill Speeds

Now let us consider the proper speeds and feeds for drilling magnesium alloy castings and forgings. To start a new job it has been found that the normal speeds and feeds used for cast iron can be used with fairly good results. Then with a little experimenting with a particular casting or forging of magnesium alloy you will find it possible to increase these speeds by as much as ten or fifteen percent. The normal speed suggested by drill manufacturers for drilling cast iron is 140 surface feet per minute. By consulting the tables of speeds issued by drill manufacturers, it will be found that a drill $\frac{1}{8}$ -inch diameter should be run at 4278 R.P.M., and a feed of .004-inch per revolution. Also a drill $\frac{1}{2}$ -inch diameter should be run at 1070 r.p.m. and a feed of .010-inch per revolution.

FIRE PRECAUTIONS IN DRILLING MAGNESIUM

Magnesium, in dust or chip form, is highly combustible. The possibility of fire resulting from drilling the alloy may be as great as in other machining or grinding. Certain precautions should be exercised both to prevent fires and extinguish them. These rules should be followed implicitly.

1. Absolutely no smoking.
2. Keep machine, floor and clothing clean. Store chips in covered metal container.
3. Keep drills sharp. Dull drills generate more heat.
4. Use an oil type cutting lubricant. Do not use water.
5. Do not use water to extinguish fire. Place 6 cu. ft. container of cast iron turnings or dry sand near each machine.
6. Do not use any other type of fire extinguisher.

Note: See TOOL ENGINEER Data Sheet, November, 1941, issue.

ON THE PRODUCTION FRONT

Broaching



BROACHING RIFLE RECEIVERS

Following pages are devoted to the practice and application of broaching — a vital weapon on the production front. A typical high production operation is the broaching of rifle receivers, pictured here. See page 84 for story. *Photo shows Oilgear single slide vertical surface broach.*

Broach Design

Fred Schytte, Chief Engineer
Canada Illinois Tools, Ltd.

Given impetus by war work, broaching has become an effective weapon on the industrial battleground. A true application of Tool Engineering, it was introduced 40 years ago and is today solving many difficult production problems in armament work.

THE cutting action of a broach is unlike that of any other machining tool. It does not have the long, flowing chip of the turning tool nor the short cut of the milling cutter or hob. The characteristic of the cut probably comes closest to the planer tool or the shaper cutter, except that broaching raises the peculiar problem of chip room.

The next outstanding difference between broaches and other machining tools concerns feed. On turning, planing or milling operations, it is possible to alter the feed to suit the

material, finish or tool life. In broaching, feed is represented by the difference in height of half-diameter of two successive teeth, the so-called step or chip per tooth. The feed is permanent because it is built-in and, all other things equal, the future performance of the broach is fixed by the designer.

Handicaps

Compared with other tools, a broach works under certain handicaps which are inherent in its construction. It is usually impossible to use clearance angles or cutting edge construc-

tions which have proven most efficient on other tools. There is a definite limit to hook angles on internal broaches because of the generating action of the grinding wheel. Problems such as holding size, guiding, and insuring even steps after many sharpenings, influence the selection of the back clearance angles. Lubrication is quite handicapped compared to the open cuts in turning or milling.

Broaching is generally regarded as very efficient. This is undoubtedly true from the standpoint of production. From the standpoint of metal cutting it is not true. Taking into account the number of cutting teeth and the actual, accumulated length of cut by each tooth between sharpenings, it is rather inefficient. Broach design from the standpoint of metal cutting amounts to doing as well as possible under the circumstances.

Slab broaching less difficult

The problems mentioned and handicaps are minimized or may entirely disappear in the case of slab broaches. There the cut is fairly open, the piece may be held by a fixture and it is not necessary to follow the usual rules for pitch and clearance angles. There it is entirely possible to duplicate conditions which in other fields of metal cutting have proven most successful. Consequently, slab broaches have a much better chance of being economical from the standpoint of metal cutting than most internal broaches.

The cutting teeth of the average broach fall into three groups: roughing, semi-finishing and finishing sections. The finishing section is to produce and hold size, the semi-finishing section removes the last few thousandths in such a way as to produce an excellent finish. By far the longest and most expensive section is

The Tool Engineer Broaching Section Contents

● Broach Design	74
● Broaching Aircraft Parts	
Flats on Hex Screws	80
Articulated Connecting Rods	81
Slotting Engine Counterweights	82
● Broaching Ordnance Parts	
Breech Block Opening	83
Rifle Receiver	84
● Broaching Tank Parts	
Engine Production Speeded	85
Accuracy in Tractor Links	86
Carburetor Production	86
● Broaching—Yesterday, Today, Tomorrow	87
● Questions and Answers	
A Practical Discussion of Shop Problems	88

spoken up by the roughing teeth for removing the bulk of the material. It is the roughing section which requires special attention. It should be as short as possible to reduce tool cost and at the same time give the longest life between sharpenings. Fortunately, no compromise has to be made here. The shortest possible roughing section where the individual teeth take the heaviest permissible cut is also the one which stands up longest.

The problem is: what is the heaviest permissible cut? In a machining operation such as turning, it is well known that the speeds and feeds are subject to considerable variation depending upon the type of material cut. Speed hardly enters into the picture in broaching because all broaching speeds are relatively low. However, in the question of feed or step per tooth in relation to the type of material, broaches are no exception among the cutting tools.

Even though the step per tooth is unalterably bound up with the question of chip room, the material problem will nevertheless enter into the picture. In other words, two broaches of identical design, one for cutting steel and the other for cutting cast iron, will not be alike in length and tooth construction. Furthermore, broaching SAE 1112, 6140, or 3120 will require three distinctly different broaches if maximum all-around efficiency is to be obtained.

Pitch

The problem in broaching centers around a perfect balance between the selected pitch, the length of cut, the thickness of cut and the type of material.

The pitch, of course, determines the tooth construction which should be strong and allow for many sharpenings. The teeth must hold broach and work in perfect alignment during cutting. For that reason there must be at least one tooth in action at all times. This is the minimum demand and applies for very thin pieces only. If possible it should be increased to at least two. It is only logical that on longer pieces this number be increased. A formula which is very commonly used for figuring this pitch is

$$P = .35 \text{ length of cut}$$

According to this formula the number of teeth in action ranges from two for a $\frac{3}{8}$ " length of cut to eight for a 7" cut.

While the pitch may have an empirical connection with the length of cut, there really is no definite rule which must be adhered to. Therefore, a departure from the above formula is quite permissible provided the desired results are obtained.

It will be proven later that coarser pitches are more economical and really result in shorter broaches. In that respect broaches follow somewhat the same rule as milling cutters on which the coarse tooth design is more favorable for roughing cuts.

Obviously, both thickness and length of cut will result in a certain amount of material removed per tooth which must be accommodated in the tooth space until the cut is completed. This chip when cutting most kinds of cast iron, brass or malleable iron is all broken up. In that case the chip

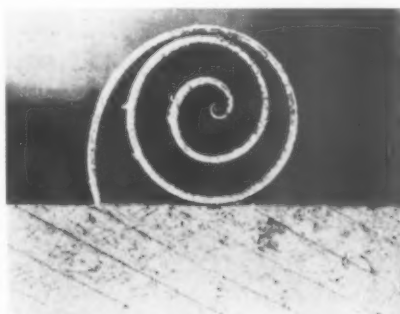


Figure 1. Thickness of material cut directly affects diameter of chip spiral.

room should be of a volume large enough to receive the amount of material removed. However, when cutting steel or any kind of material which results in a continuous chip it becomes necessary to qualify this conception of chip room.

Upon completion of a broach cut it is necessary that the chips fall out



Figure 2. Smaller spiral due to thin cut.

readily. The tooth space need not be made so large as to accommodate two or more chips because the first ones failed to fall out after the cut was completed.

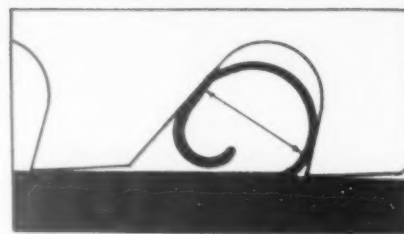


Figure 3. Tests on diameter of spiral chip were made with usual broach cutting angles of 15° hook and 2° back clearance.

Any chip which must be crowded into too small a space offers an increased resistance to the cut and prevents the metal from freely flowing away from the cutting edge. In addition to dulling the teeth prematurely, this may result in a torn or rough surface especially in soft annealed steels.

For broaches which are cutting steel, the term chip room may, therefore, be defined as a space sufficiently large to allow the chip to flow freely and not cause it to stick.

Chip Formation

It may be observed on any metal cutting operation that a chip from a cut through steel rolls up in a spiral. At this point it is necessary to correct a common misconception that this spiral was formed by the shape of the tool. This could probably be done but would certainly not be advisable. It is the natural tendency for the chip to form a spiral. To impose a different form or a more compact spiral on the chip would necessarily add resistance to the cut and hinder the flow of the cut from the cutting edge.

From observations and tests it has become clear that, besides the length of cut, the size or diameter of the chip depends on the thickness of cut. Figures 1 and 2 show chips cut by a plain tool having the usual broach cutting angles of 15° hook and 2° back clearance. There was nothing on this tool to shape these spirals. They represent the natural tendency of the material during a cut, depending on its thickness.

Numerous tests were conducted with a plain tool on SAE 1112 cold rolled, free cutting steel. Length and thickness of cut were varied and the resultant chip spiral was recorded. These recorded sizes, when plotted on a graph, revealed that the diameter of the chip spiral is quite proportional to the length of cut.

Applying these observations to the

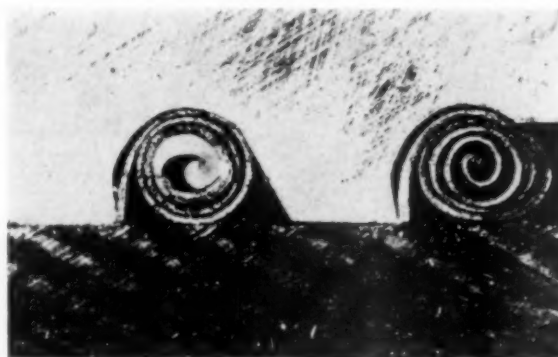
previous definition of chip room, it must be stated that any chip room is insufficient where the natural tendency of the chip interferes with the shape of the tooth. (See Figure 4).

Figure 4. Any chip room is insufficient where the natural tendency of the chip interferes with the shape of the tooth.



In a well-designed broach, chip spiral and tooth space, i.e. pitch, correspond. (See Figure 5). Too large a chip space would be a waste of material.

Figure 5. In a well designed broach, chip spiral and tooth space correspond. Too large a chip space would be a waste of material.



So far the question of material has not been touched upon. Sticking of the chips on an experimental broach occurs when the broach is pulled through soft SAE 4620 steel. When the same broach is pulled through a harder SAE 4140 material the chips do not stick and the performance of the broach in general is entirely satisfactory. The chips from these two passes are shown in Figure 6.

Material

Figure 6 bears out the point that a broach can be designed only for one material, or rather, for one condition only. Even within the same material there is quite a variation in chip size depending upon the hardness.

Tests were made to show the behavior of the various steels under different degrees of hardness. Tooth form had no influence on the formation of the chips which were free to

roll into a big space. Two passes were taken under each condition and it is important to note that they are consistently alike. This may dispel any doubts that chip formation really fol-

lows a definite rule and is not merely accidental.

When the sizes from other lengths of cut were tabulated, they revealed the same proportionability to the cut-

ting length as determined previously for SAE 1112. The absolute values, however, were quite different from those for SAE 1112 but were always proportionally either higher or lower, depending on the type of material and the condition.

Due to this proportional relationship it was not necessary to make all these tests for various lengths. By once establishing the size of the chip for a certain length of cut and comparing it with the size of the corresponding chip on SAE 1112, a ratio can be obtained. Inasmuch as this ratio is uniform for all other cuts, a table may be obtained by simply changing the sizes in proportion to the newly established ratio (See Figure 7).

Listing the various factors which contribute to the size of the chip according to their importance, first place must be given to the length of

cut. Next comes the thickness of the cut, followed by the hardness. The softer the material the wider the chip spiral. In fourth place comes the particular composition or the structure of the material.

Chip Rating

To express the results of all these tests in the form of figures which may be used in the design of broaches, the same procedure was used as in listing the machinability for various materials. There the machinability of SAE 1112 is listed as 100% and the rating for other materials is in percentage of the performance of SAE 1112. Similarly, on broaches, the chip sizes of various materials will be set in relation to the corresponding sizes from cuts on SAE 1112. The new term is **CHIP RATING** and is obtained by dividing the chip size of a certain cut on SAE 1112 by the chip size of the same cut on the particular material. A value or less than 1.00 means, the chips for this material will be larger than SAE 1112 chips. In a way, this chip rating is somewhat of an efficiency factor. The higher the rating the shorter and less expensive the broach.

In a general analysis it can be found that the chip rating is the direct result of the ductility of the material and, to a lesser extent, the presence of those constituents in the ferrite which have the tendency to break up the chip. In that respect the chip rating follows closely the machinability rating. However, where the latter decrease with increasing strength and hardness of the material, the chip rating continues to increase.

In general the following fact holds: lower the ductility the higher the chip rating. Grain size and thermal treatment prior to broaching also have their influence but again their merits are in proportion to the extent to which they influence the ductility. Large grain size lowers the ductility and is therefore beneficial to the chip rating.

Because of the number of influences affecting the chip rating, it is undoubtedly safest to determine the rating of the material on which the broach will be used prior to designing it. If that is not done, or cannot be done, then the engineer must make an assumption regarding the state the

material will be in at the time of broaching. The logical assumption is that the hardness will be within the range recommended for good machinability. To be safe, the broach must be figured on the basis of the rating for the low point of this range, which would be around 5° Rockwell.

In actual practice, cuts of an even thickness occur rarely. The cut of a round tooth, for instance, must be separated into a number of narrow cuts to avoid the forming of a solid chip ring which cannot be removed. This is done by chip breakers. Their duty is not only to break up the chip but also to space the individual chips so that any interference between them may be avoided.

Chip Breakers

Chip breakers are spaced alternately. This means that the following tooth removes, along with the regular cut, the material which has been left by the preceding chip breakers. This fact is very important in a system which insists on a strict relation between thickness of cut and chip space.

A round broach presents its own problems. A large part of the cut is

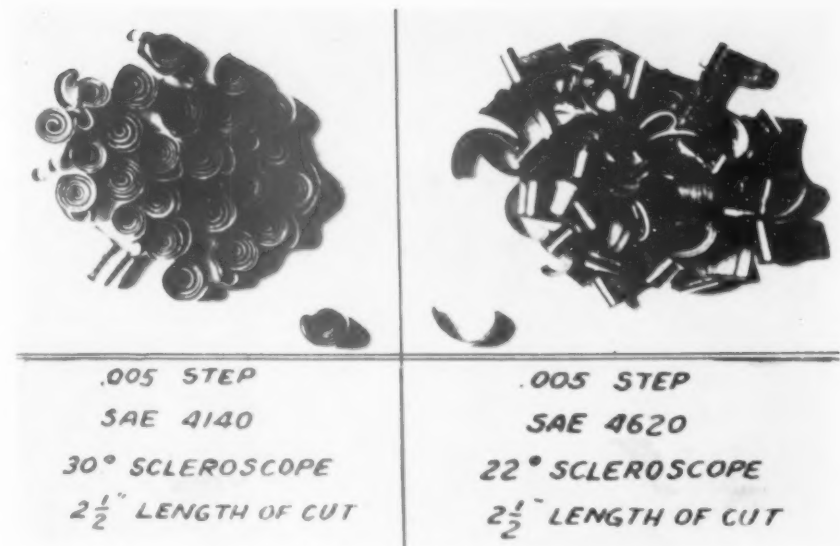


Figure 6. Results of tests on broaching hard and soft steel show that chips tend to stick on the softer material.

These chip breakers, however, are narrow because it is not necessary to space the cuts like on round broaches. They have plenty of space to roll into. By far the widest part of the chip is of an even thickness and will curl up accordingly. Steps for keyway and spline broaches are, therefore, to be taken as figured.

must be held exactly as obtained from the table. A certain amount of freedom is permitted. At all times, however, it must be realized that a considerable increase over the calculated thickness of cut will result in either sticking or too much resistance against the free rolling of the chip. A smaller step, unless dictated by

MATERIAL ROCKWELL	SAE - 1020 B - 60	SAE - 1215 B - 68	SAE - 1315 B - 72	SAE - 4140 B - 75	SAE - 6145 C - 20	SAE - 2315 C - 20	SAE - 6145 C - 21	SAE - 1335 C - 22	SAE - 3120 C - 23
.0005									
.001									
.002									
.004									
.006									
.008									
.010									

Figure 7. Tabulation of results showing proportional relationships of chip formations on various S.A.E. steels.

of a double thickness and must be that way in order to create a wide spacing for the individual cuts. Therefore, when obtaining steps for round broaches from our tables, they must be divided by two, or rather, the steps obtained are those for the diameter and not for one side.

Cuts of keyway and spline broaches are also split up by chip breakers.

The same applies to slab broaches as long as the width of the chip breaker is narrow compared to the rest of the cut. If that is not so, then the step must again be divided by two for the same reason as on round broaches.

Figuring broaches according to this system must not be taken as a mathematical process by which the step

other reasons, increases the tool cost unnecessarily. Both of them result in a shortened tool life.

This system provides the logical background for all broach calculations and as such will do more towards all-round economy in broaching than all the trick designs combined. The broach is and remains a cutting tool subject to the same rules

and considerations as all other machining tools. Skin cuts are detrimental to tool life but so is any resistance against the free flowing of the chips from heavier cuts. Sound broach design avoids both and this system provides the means towards this end.

Rifling gun barrels

The foregoing has dealt only with the elements of broaching. Many problems are put up to the broach designer, some quite easy but one of the

back and forth through the bore of the barrel. The barrel is indexed at the end of each stroke. After a complete indexing the tool is advanced. This cycle continues automatically until full depth has been reached in all grooves. Lubrication is applied to the tool through the rod and head. The lead is imparted to the head by either a sine bar or a helical guide.

The tools used in this process of rifling require a great deal of attention and care. With expert handling,

ther research.

During the course of these experiments, one company received 100 barrels for test purposes. Attempts at broaching these guns with one pass proved a failure. The grooves in these guns were deeper and the barrels considerably longer than those previously tested.

The current armament program, however, gave new impetus to the method of rifling by broaching. The Rock Island Arsenal again revived interest by asking for quotations on broaches and a fixture for rifling small caliber machine gun barrels. The fixture was to be attachable to any standard broaching machine.

This fixture and the rifling broaches were designed around the same principle which had been proved successful during the early tests. However, previous experience had indicated that doing the entire job of rifling in one pass came very close to overloading the tool. For that reason the new broaches have been designed for two passes.

After a few tests and some minor improvement in the finish of the broach teeth, barrels were produced which looked good and justified the expense of extensive firing tests. The tests revealed that the accuracy of fire was equal to any barrel produced by the old method. The behavior and wear of the barrels under extensive firing was up to standard.

Some curiosity was aroused by the fact that a slightly higher muzzle velocity was observed with broached barrels. This phenomenon may find its explanation in the fact that broaching creates very uniform spirals. There

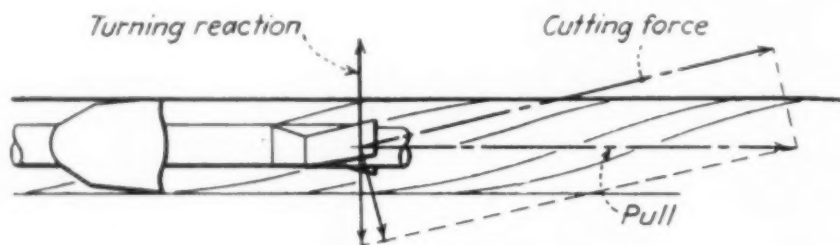
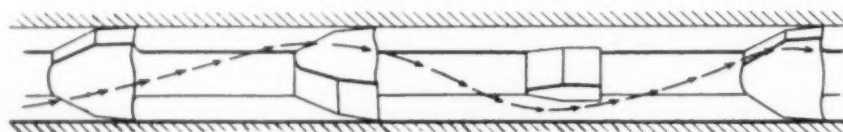


Diagram of forces in rifling gun barrel.



Path of broach teeth in rifling gun barrel.

hardest if not the hardest is that of rifling gun barrels by broaching.

In the past all rifling was done on special rifling machines. While there are several makes of these on the market, all use the same principle. For a small caliber gun or rifle, these machines use a single point tool of correct width and helix angle, and for a large gun, a single or double point tool which fits into a head which slides

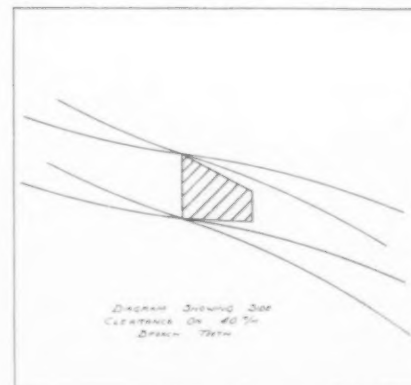
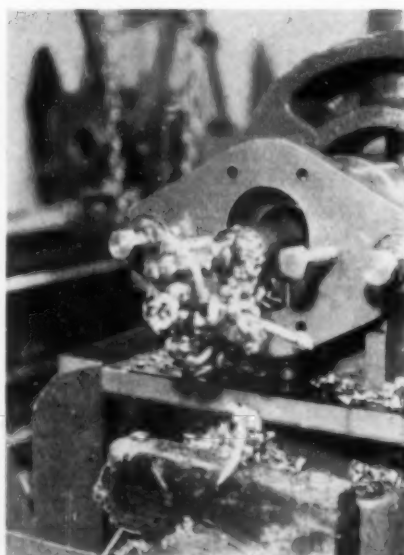
however, this method will produce accurate barrels and excellent finish. The criticism of this rifling process lies in the time expended in finishing a barrel and the necessity for skilled handling of the tool.

It had long seemed logical to apply broaching to the process of rifling small caliber gun barrels. A great many attempts have been made in the past to solve this problem, but with the exception of some success with pistol barrels, the net results had turned out to be zero up until quite recently.

In 1938 the Rock Island Arsenal reopened the issue, when it requested broach manufacturers to submit proposals for equipment to broach small caliber gun barrels. This request marked the beginning of a long series of tests and experiments which finally resulted in the first successful rifling broach.

The first tests conducted at that time were an effort to establish certain basic data. Eventually, actual barrels were produced with a single pass broach. While the finish in these first barrels was not strictly up to Ordnance Department standards, it was sufficiently good to warrant fur-

Chips falling from end of barrel.



Side clearance of broach tooth rifling gun barrel.

can be no indexing errors or variations in lead due to torsional stress and resulting wind-up. Thus the width of the lands is the same throughout.

On the basis of these favorable reports, the Rock Island Arsenal, with the sanction of the U. S. Ordnance Department, proceeded to broach 1,000 barrels. The production was intended to prove the reliability of the operation. Incidentally, it was also to give an idea of the overall production cost.

At the conclusion of the tests, the Rock Island Arsenal reported an increase of 15 to 20 times the production of a single tool rifling machine. This enormous increase more than offset the increased tool cost. On the whole a substantial saving in the cost of the operation per barrel was reported.

The experience acquired during the production of these 1000 barrels revealed the necessity for maintaining the tools in first class condition. It became equally apparent that the average horizontal broaching machine, designed for ordinary broaching applications and heavy pull, had its shortcomings as far as rifle broaching was concerned. Neither hydraulic nor screw actuated machines as then designed operated smoothly enough.

Slight differences in the shading of the finish resulted, due to small variations in the cutting speed. While this was not to be confused with the wavy condition sometimes observed in broached holes, it was nevertheless disturbing to the eye of the ordnance inspector. These observations led to the development of a line of rifle broaching machines, broach sharpening machines, and inspection fixtures



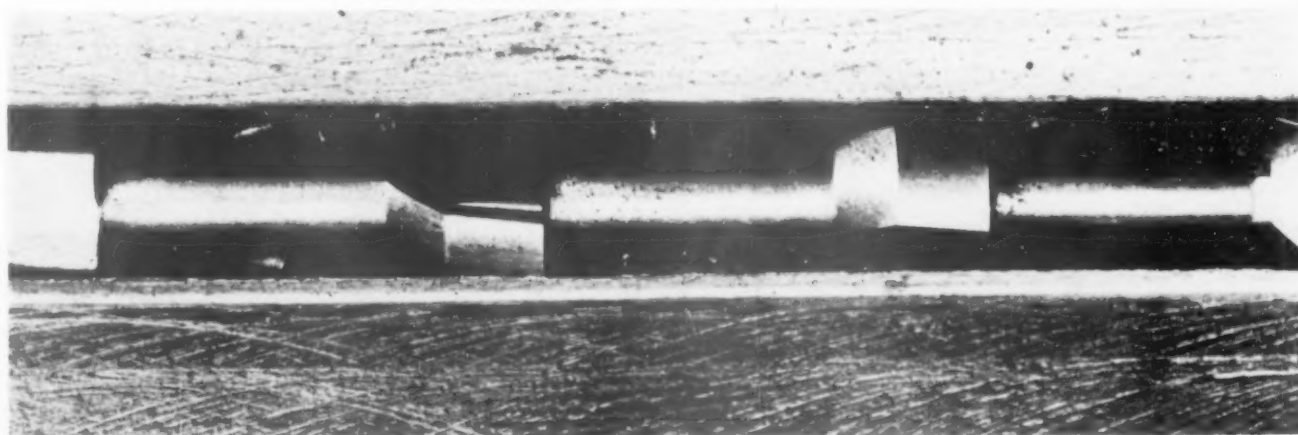
Changing broaching tool in rifling large caliber gun.

for broaches.

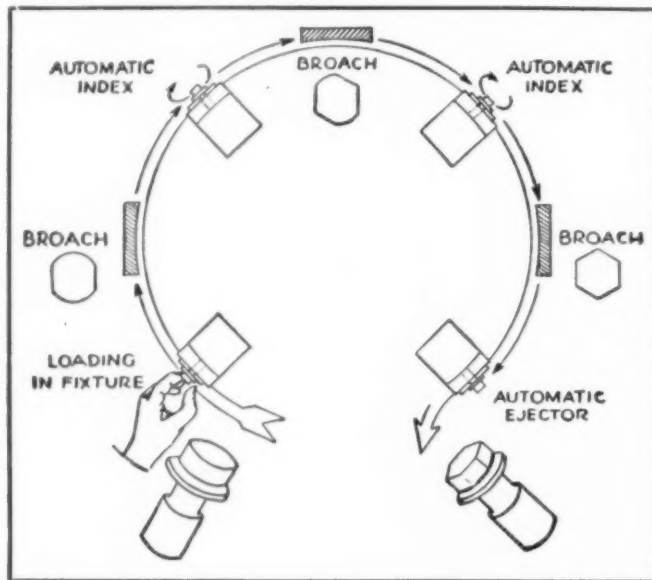
Since the early tests, the principle of broaching machine gun and rifle barrels has not been varied, although minor changes have been made from

time to time in effort to improve the finish or to increase the tool life. In general, however, rifling by broaching is an established process, definitely out of the experimental stage.

Broach teeth passing through barrel illustrating chip disposal.



Broaching Airplane Parts



Photos courtesy American Broach & Machine Co.

Six flats on hex screw are broached to .001 limits.

BROACHING six flats on hex screws on a continuous broaching machine, the operator merely applies the work. The work passes between two broaches, puts two opposite flats, the fixture indexes automatically, repeats the operation through another stage of two more broaches, and again repeats the operation until three distinct cutting operations have been performed. The piece is automatically ejected upon completion.

Production as high as 1,200 finished parts are obtained on this type of equipment. Limits are held to .001-inch across the flats, and the depth of the head is maintained within .010-inch. Location is maintained on width, centralization and depth.



Surface broaching articulated connecting rods

SURFACE broaching all four sides of articulated connecting rods for radial engines in four passes on two machines is one of the most recent developments in materially reducing the time required for machining important components of engines needed for the war effort.

With this process only 11 seconds are required for each of the four passes, or a total cutting time of less than three-quarters of a minute. The inserting and removing time to and from the fixtures is also low, due to their quick-wading design and the type of broaching machine used.

The parts are broached directly from the "as forged" condition on a 10 ton, 66 inch stroke single ram broaching machine. Two fixtures are used, one for broaching the sides parallel with the hole openings and other for the sides which run into the profiled cylindrical outer surfaces of the rod ends. The sequence of operations is as follows:

Before the holes are drilled in the ends of the rods, the fixture shown in Figure 1 is used. In the first pass the broach faces the entire surface including the flats for the holes. Then, using a different set of locators, the piece is turned over and the similar face on the opposite side is broached. Approximately $\frac{3}{16}$ ths inch of metal is removed in each pass, the amount varying due to differences in the size of the rough forgings.

Because of the heavy pressure exerted on the piece, tending to make it turn or slip in the fixture, double wedge-cam type clamps are used. The clamps are V-shaped with serrated surfaces where contact is made with the large end of the rod. The V's serve to locate the piece in the fixture. The clamp for the small end is flat and also serrated for tight clamping effect.

To obtain uniform clamping force even though the size of the forging may vary, ample clamping space is provided and the roller-type cam followers are mounted on ball bearings. The wedges also slide on ball bearings. A third factor in holding the piece tightly is that the hydraulic pressure used to operate the clamps is continuously applied while the piece is being broached.

After broaching the faces in the

first fixture, the pieces are drilled. The condition of the piece is shown in the upper view in Figure 3. The pieces are then mounted in the fixture as shown in Fig. 2. In this fixture the holes are used for locating the piece. The broach again removes approximately $\frac{3}{16}$ inch of metal along the faces, but is tapered away from the piece at the ends of the flat surface to allow for a succeeding profiling operation around the rod ends.

The piece is then turned over and using different locators, is broached on the opposite face. The ends are then profiled and appear as shown in the lower view of Figure 3.

The fixtures are mounted on receding tables of the hydraulic cam lock type for quick loading. Clamping is also hydraulically controlled, the cylinders operating the clamps, especially those used in the first operation, being designed to provide the high clamping force mentioned above. In combination with the wedge cams, it is possible to exert enough force to push the serrated clamps of this fixture securely into the surfaces of the piece. And with the continuous application of this force during the broaching operation, no difficulty from slipping in the fixture has been experienced.

Figure 1

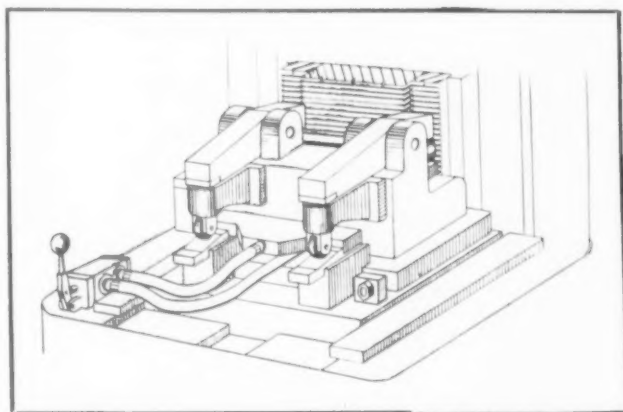


Figure 2

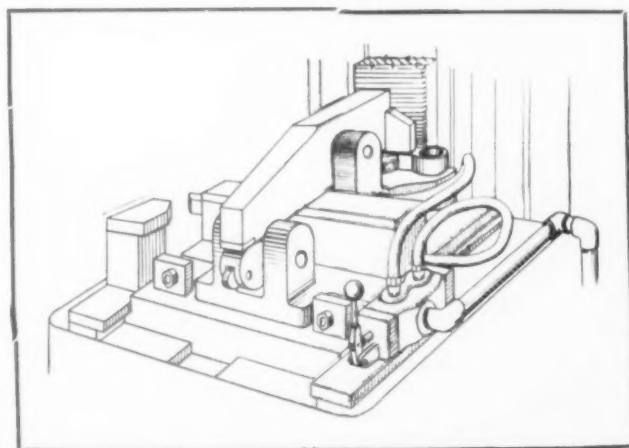


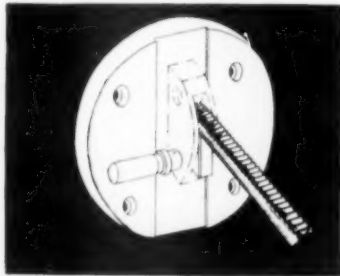
Figure 3



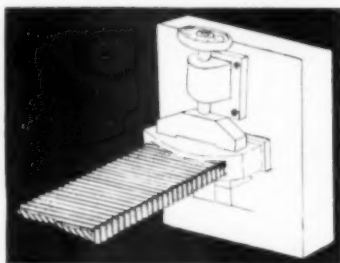
Photos courtesy of
Colonial Broach Co.

Slotting aircraft engine counterweights

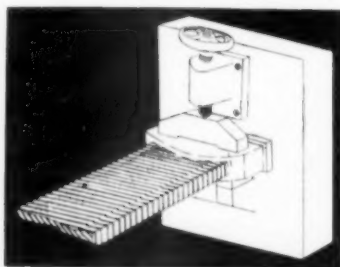
Figure 1. Sequence of five broaching operations following operation 1—rough milling—are slots in counterbalance weight of radial type aircraft engine.



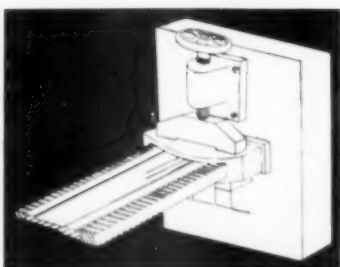
Operation 2 & 3



Operation 4



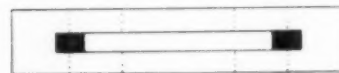
Operation 5



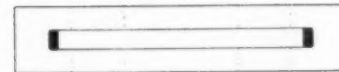
Operation 6



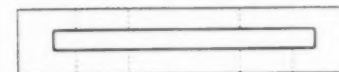
1ST OPERATION



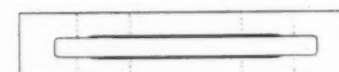
2ND OPERATION



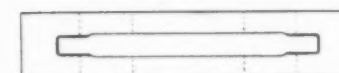
3RD OPERATION



4TH OPERATION



5TH OPERATION



6TH OPERATION



A Colonial horizontal broaching machine of 25 tons capacity and 72-inch maximum stroke is used for the five slotting operations shown in the diagram above.

FIVE operations, slots in the counterbalance weights used on the crankshaft of a well-known radial type aircraft engine are broached completely on a single horizontal type broaching machine, using but two fixtures with four different broaches.

Sequence of operations is shown on the accompanying diagrams. After the first rough milling operation, remaining excess stock is removed in operations 2 and 3. This is done in two steps using the same broach for all passes in both operations. The broach, a solid type with an effective cutting length of 55 inches, removes approximately 0.5-inch of metal per pass. Cut width is 0.787-inch. The fixture for these operations locates the counterweight by a plug placed through one of the reamed pin holes and through a bushing in the arm of the fixture.

In the 4th operation the two ends and sides of the slot are machined in one pass. A solid type broach, with an effective cutting length of 40.25-inches, increases the width and length of the slot approximately 0.04-inch. The fixture is of the clamp type.

Operation No. 5 uses the same fixture as for No. 4. Only the broach need be changed. The center section of the slot faces are relieved about 0.09-inch in width.

Operation No. 6 accurately finishes the total length and the end width of the slots. Finished slot length must be between 8.362 and 8.366 inches, with similar tolerances specified for the slot width. An inserted tooth type of broach is used, with an effective cutting length of 15 inches. The same fixture is used as for Operations 4 and 5.

In processing counterweights, a specified quantity is run through each of the broaching operations before the fixture or broach is changed. This enables the engine maker to maintain production schedules. Cutting speed for all operations is 30 feet per minute.

Broaching Ordnance Parts

Three operations on breech block opening

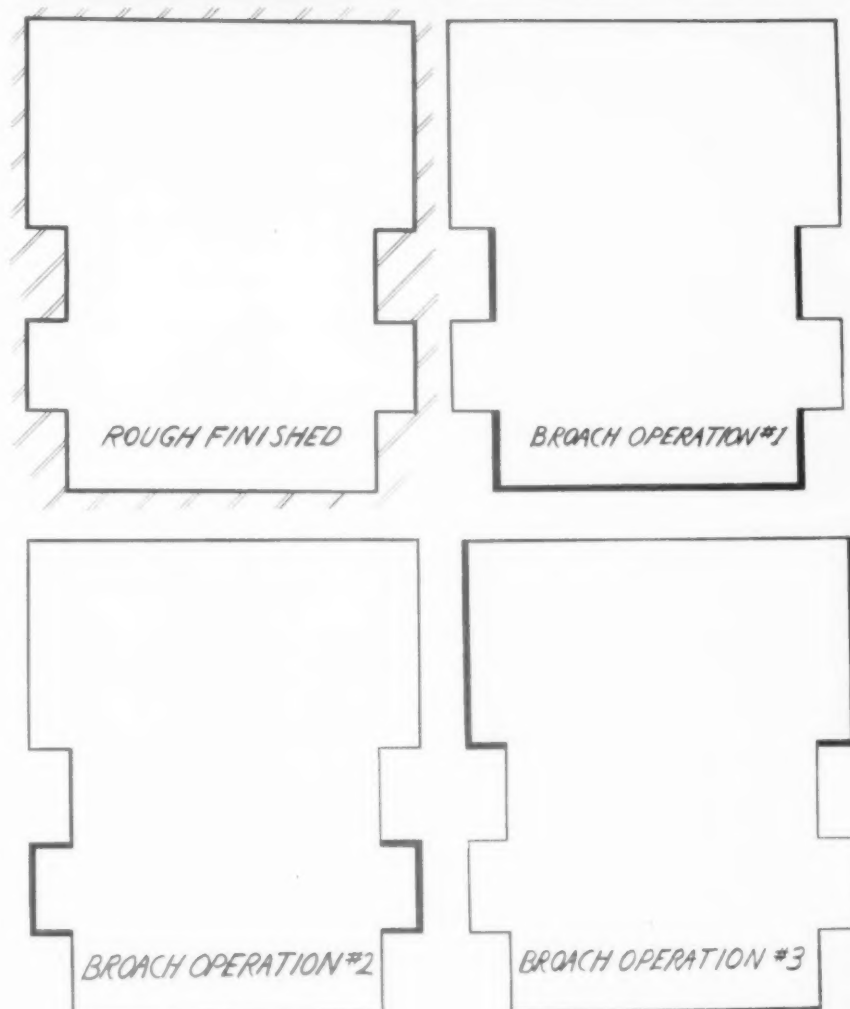
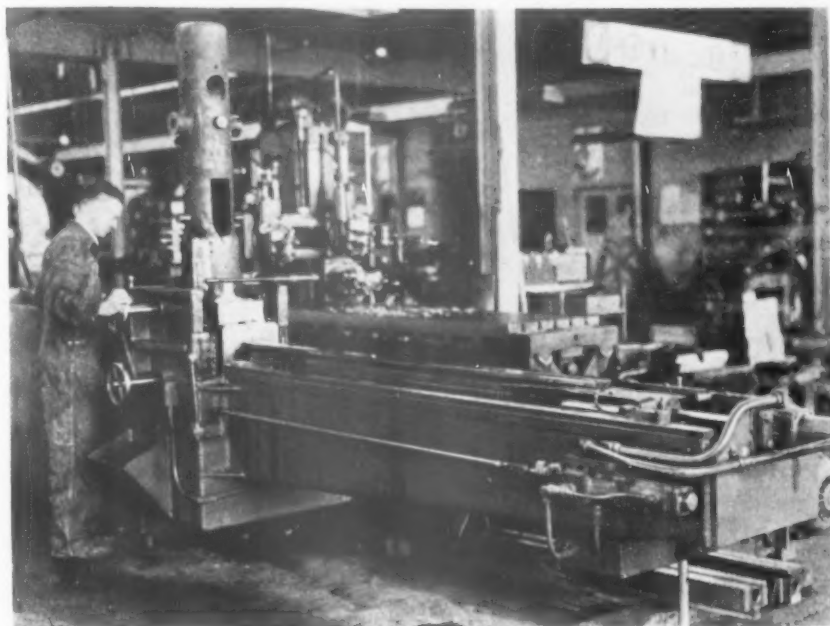
THE breech block opening on the breech housing of a 3-inch naval training gun is broached to finish dimensions in three operations. Coming to the horizontal broaching machine, rough finished, a maximum of 1/16 of an inch of stock is removed from the casting. Where a slotter once took 8 to 10 hours, plus hand scraping and filing, the job is now completed in one-eighth of the time.

An unusual feature of this operation is that in addition to finishing the hole to true dimensions, the broaches maintain the exact location of the hole as it was cast into the breech housing. Guides, grooved with keyways, are positioned on the fixture fore and aft the workpiece. One set of guides maintain location for two operations, both of which are done on the same machine. Because they are positioned directly in the path of the third operation, a second set of guides is required, and another machine is used for this last job.

Guides are not needed in many operations, nor are there many instances where they are applicable. This job, however, serves as an interesting example of their possibilities.

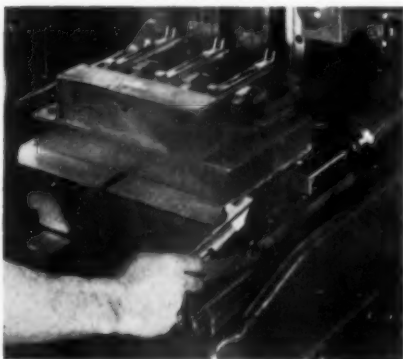
Another feature of the tool used in broaching the breech block is that broaching tools are screwed to an ordinary ground steel bar. This affords simplicity, in that a number of straight designed broaches can be affixed to it in the proper pattern. Also, a considerable amount of high speed steel is conserved. As the tools are ground down, it is a simple matter to shim them up, helping to prolong life and effectiveness.

A horizontal machine of 75,000 pounds capacity, with a 72-inch stroke is used.



***Photo courtesy the
Detroit Broach Co.***

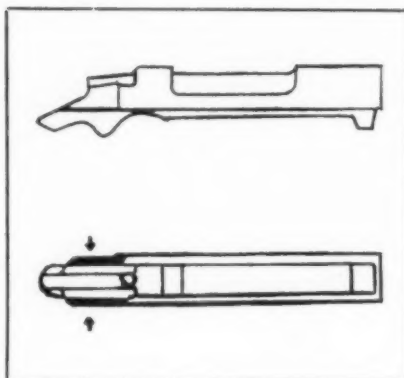
Broaching mass-produces rifle receiver on Russian gun



Left—Closeup showing how three rifle receivers are broached in one operation.

Photo and drawing courtesy of the Oilgear Co.

Right—Heavy lines show flats broached on rifle receiver.



Important to mass production is simplicity of individual operations. In broaching the rifle receiver for a Russian gun, simplicity has been achieved to a considerable extent on a single slide machine. The broaching tool finishes both sides of three rifle receivers in one cycle. On each side of each receiver, .120-inches of stock is removed. Production is about 600 per hour. This job can be done by unskilled operators. It requires no fixture or clamping device for holding the work, in that operation of the broaching tool itself suffices to hold it in place. This is not an unusually difficult broaching job, but it does indicate high production. The rectangular shape of the rifle receiver permits simple tool design. Tool life is almost indefinite. As is shown in the drawing, only a small portion of the flat surface of one end of the rifle receiver is removed by the broaching tool.

Continuous feed speeds production on shell fuse body

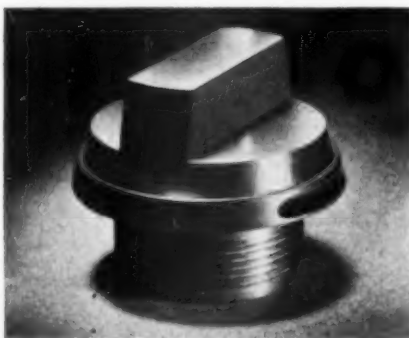
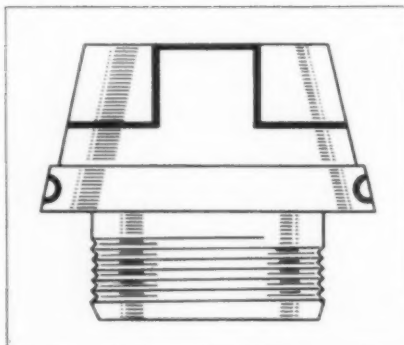


Photo and drawing courtesy of Detroit Broach Co.

Fuse body moves through machine on conveyor. Broaching tool is stationary.

Right—Shell fuse body after broaching on Foote-Burt continuous feed broaching machine.



ANOTHER high production broaching operation is used in the manufacture of fuse bodies for shells. As the piece comes off the automatic screw machine, the operator inserts it in one of the fixtures on the conveyor chain of a continuous feed broaching machine. The broach is stationary, the work piece being pulled across it. Production of fuse bodies is around 1,000 per hour. The machine removes approximately 330 pounds of metal in that time, a rather remarkable production rate, even on mild, free machining steel.

Parts are clamped to the chain fixture and unloaded automatically. As is shown in the diagram, a number of surfaces are broached in one operation. This same job can also be done on a vertical surface broaching machine.

Broaching Tank Parts

IN producing the nine-cylinder R975 —400 h.p. radial aircraft engines for military tanks and training planes, a multiplicity of surface and hole broaching and burnishing operations is now performed on such parts as the crankcase, cylinders, counterweights and many smaller parts.

The presses are used in unusual ways for some of the operations, being equipped with special fixtures incorporating broach guide bars for extreme accuracy of alignment.

An example is the surface broaching of four flats on the flange of each cylinder by a 10-ton, 42-inch stroke machine. The four flats on each cylinder flange permit a closer spacing of the cylinders around the periphery of the crankcase and also reduce its overall depth, thus increasing the compactness of the engine.

The ram is equipped with an attachment having two drawing bars, the broaches being fitted with three sets of cutting teeth on each side (Figure 2). A series of three cuts is taken on each pair of flats, the cylin-

Figure 1. Press equipped with special fixtures incorporating guide bars. Photo by Colonial Broach Co.

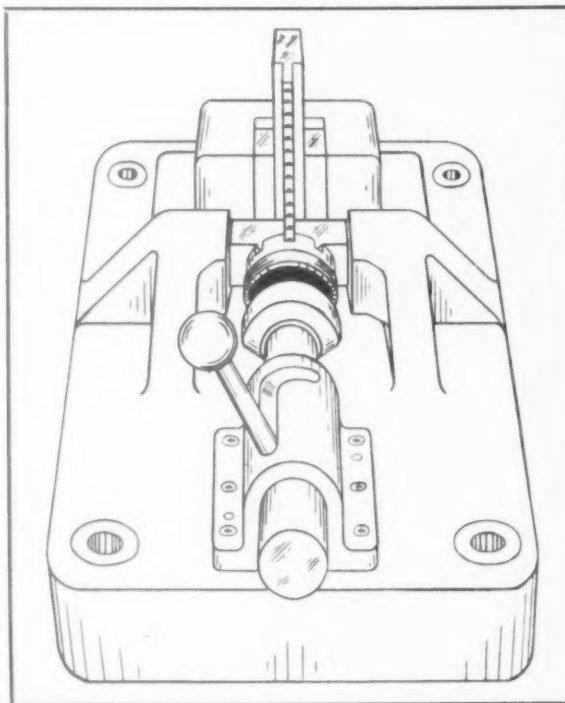
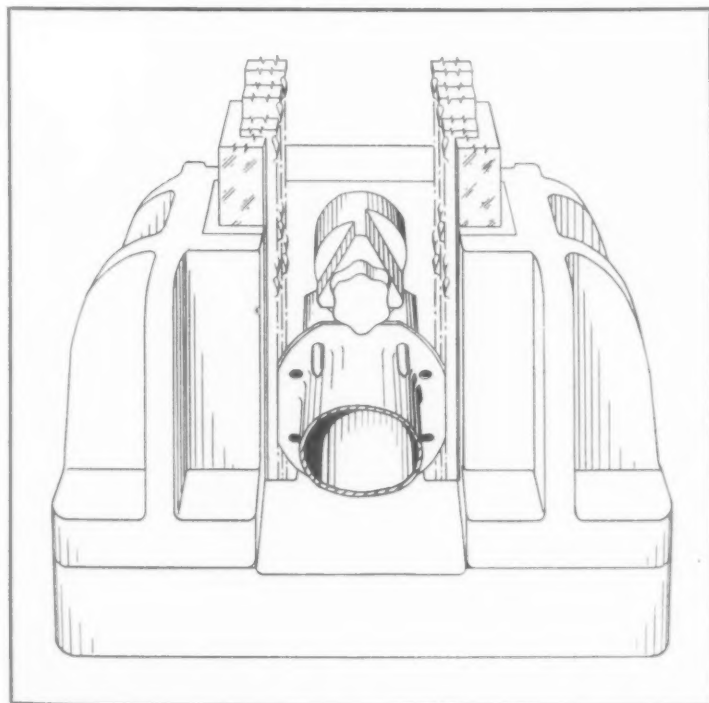


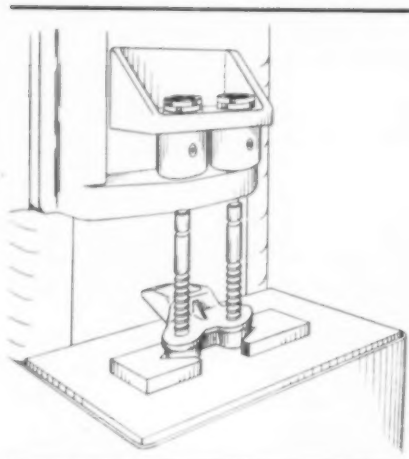
der being advanced by a manual indexing fixture. About 9/16 inches of metal is removed in the three passes, the final dimension being held to close limits.

Another unusual application is in slotting a special packing nut, using a 3-ton, 24 inch stroke machine. While "castellating a nut" would normally be of no special interest, since this operation is usually done by gang milling, the precision required for the finished part and the demand for a

much higher productive capacity than obtained when the parts are milled singly compels the use of a more accurate method, so broaching was selected. The fixture used to index the nut (Figure 3) permits making all three passes or cuts across the face of the nut in approximately 15 seconds. Four seconds are required for each cut, plus three seconds for indexing. The indexing is manual, the ram stopping at the top of each return stroke.

Below—Right, Figure 2; Left, Figure 3.





Broaching tractor link speeds tank production

VASTLY increased production with greater accuracy is now being attained by broaching all machined surfaces and holes in the crawler-type track links used in various types of tractors and tanks. About 500 of these links are required per complete assembly depending upon the overall length of the track.

As shown in Figure 1, the flats on each side of the holes are broached. The holes must be accurately spaced to maintain the desired overall length of the assembled track. Finishing the holes to close limits is also essential to obtain proper fit of the link pins. Formerly the holes were drilled and reamed and the flats were milled. By surface broaching both flats simultaneously production time was further reduced. Similarly, the adoption of

broaching for finishing the holes saved valuable equipment and time for other purposes. Figure 1 shows the part after surface broaching and prior to finish broaching the holes.

After the holes are drilled to 1-1/16ths inches in diameter they are broached in a fixture as shown in Figure 2, the tool being pulled through the work. Both holes are finished broached simultaneously in each link in a single pass. Finish dimension is 1 1/8 inches. The pieces are placed in a simple V-block locating fixture, which positions them both endwise and sidewise and aids in obtaining the accurate hole spacing desired. Each machine and fixture as shown is capable of broaching up to 110 pieces per hour. The pieces are alloy steel forgings designed to withstand severe abrasion and to provide high tensile strength and resistance to bending in service.

At left, Figure 1 top.
Figure 2 below.

Two operations performed on a carburetor



Photos Courtesy Colonial Broach Co.

TWO broaching operations performed on a carburetor indicate the diversity of purposes to which the modern broaching machine can be adapted.

A pull down type of broach is used to "snag" the flash from the outer ends of the throttle body, previous to the first machining operation. Formerly done by hand, the work had to be located for the first machining operation from the rough casting surface. By broaching a finished pair of surfaces to close dimensions is provided. They can be used for accurate location on subsequent operations. Production on this operation is about 540 per hour.

In the second application, broaching was used to solve a peculiar problem having a direct bearing upon the performance of the carburetor in actual service. Absolutely identical diameters are required for the two holes through which the mixture passes. A variation of as much as .0002-inch between the two holes is considered

enough to alter the accuracy of mixture distribution. The only way this accuracy could be maintained was by broaching each hole with the same broach. The problem was solved by having each machine carry two broaches. Two throttle bodies were broached at one time, the holes in each being done on one tool. Production averages about 250 per hour. With each stroke, the second hole in one piece is finished, while the first hole in the other piece is broached.



THE TOOL ENGINEER

Broaching Progress

**J. A. Lapointe, American Broach and Machine Company,
Discusses Broaching Yesterday, Today and Tomorrow**

IN 40 years of continuous activity in the development and manufacturing of broaching equipment, I have seen outstanding progress. But there is a greater future for this widely accepted operation known as broaching.

In 1902 broaching was introduced as a commercial metal cutting operation. The machines at that time were belt driven, having very little power, and were confined mostly to broaching keyways in bores.

By 1904, the machines were of the same type, but built heavier developing greater pulling capacity. Square hole broaching became popular, using pull type broaches which were followed shortly by multiple spline broaches where several keyways were pulled at one time in a single part. The limits on splines in 1904 to 1907 were usually plus .004 minus .000; on square holes, plus .006 minus .000.

Along in 1905, 1906 and 1907 square holes were more popular than the multiple spline holes in transmissions, sliding gears, and the time for broaching a hole of approximately 1¼ inches square in gears having a length of 1½ inches, was about six minutes, using in some cases three broaches.

The sliding gear with square hole was gradually replaced until in 1910 practically all sliding gears had holes broached for operating on four spline shafts. The number of splines has increased and today the square hole has entirely disappeared from use in transmission gears. The limits today on the width of the splines of a spline broached hole are usually plus .0002 minus .000, compared with plus .004 minus .000 in 1907. The time for broaching a multiple spline hole in 1907, on a size of approximately 1¼-inch bore, length of part 2-inches having four keyways all broached at one time was about 2-½ minutes on a mechanical belt driven machine.

Today on the new type of semi-

automatic vertical hydraulic broaching machine, eight or more pieces can be broached in the same time.

Tools in the early days were made of carbon steel. The introduction of high speed steel pull type broaches was made just after the World War.

During the first World War considerable operations were put into use where broaching played a very important part and these same operations exist today, plus hundreds of new ones to meet the change in demands.

As an example of broaching progress, gun barrels were rifled with pull broaches during the first World War — to my knowledge, the first time that a barrel of approximately 1-7/16-inches bore was rifled with pull broaches. The limits on the width of the spiral grooves was plus or minus .002. The length of the barrel was approximately 42-inches. Several broaches were used. The actual cutting time required approximately 15 minutes. Today this same size barrel with the use of pull broaches can be broached with a cutting time approximately six minutes, with limits reduced to tenths of thousands and a better finish.

Many factors have greatly assisted in the superior results, such as the steel, the method of grinding the tools, heavier machines, hydraulic feed, automatic broach gripping heads, and knowledge of cutting edges and booth construction obtained thru the years of development.

Forty Years of Broaching Development

1902. Belt driven screw operated broaching machines of light pulling capacity used mostly for broaching keyways in bores.

1904. Heavier machines of the same type used for broaching keyways and square holes. Machines operated at a cutting speed of approximately six feet per minute.

1911. Double spindle horizontal broaching machines were introduced with cutting speeds increased to eight feet per minute.

1912. Surface broaching operations were introduced. Large internal gears were broached, broaching several sections at a time and indexing the work.

1919. High speed steel pull broaches ground all over were introduced. The limits on splines reduced to plus .001 minus .000.

1921. High speed rack operated horizontal broaching machines introduced, having a cutting speed up to 18 feet per minute.

1925. Hydraulic horizontal broaching machines were introduced, having a cutting speed up to 24 feet per minute.

1926. Vertical surface broaching machines, rack operated, were offered to the trade.

1926. Surface broaches of built-up type consisting of several sections bolted into holders were used on these machines.

1928. The first introduction of vertical hydraulic pull type broaching machines provided with semi and automatic broach holding mechanism greatly increased production. Machines were capable of operating up to 24 feet per minute.

1930. Chain type broaching machines of continuous operation type for surface broaching operations for small parts were placed on the market.

1931. Full automatic vertical internal broaching machines, hydraulically operated having cutting speeds up to 30 feet per minute.

1933. Rotary type continuous broaching machines for surface broaching operations.

1938. Three-way hydraulic operated vertical type broaching machines, suitable for push broaching, pull broaching and surface broaching, the first universal broaching machine placed on the market.

1940-42. Many new operations engineered for high production on essential war equipment.

Questions and Answers *on broaching practise*

Harry Gotberg, Chief Engineer, Colonial Broach, discusses some shop problems

In vertical broaching can fewer broach teeth in contact be used than in horizontal broaching?

There is really no material advantage in having less teeth engaged except for the capacity of the machine. If a machine is already in your plant the force required is determined by the step taken per tooth and the number of teeth engaged. If the force is too great for the capacity of the machine it is usually overcome by reducing the step per tooth. This is preferable to reducing the number of teeth in contact, since the pitch of the teeth is of greater importance to the proper performance of the broach than the step per tooth. The pitch of the teeth must at all times be sufficient to allow proper chip clearance for the step per tooth. This is governed by the length of the part being broached. These qualifications apply to vertical broaching as well as to surface broaching on a horizontal machine.

* * *

What pull constant should be used when figuring for SAE-4820 steel?

The formula for estimating the force required is based on a combination of the area in contact, the step per tooth, the number of teeth in contact, and a predetermined constant. For SAE-4820 steel we use a constant of 600,000.

* * *

How should harmonics be avoided?

By harmonics, it is assumed, is meant the "jumpy" action encountered in internal broaching and a "chatter" in surface broaching. This "jumpy" action also refers to the excessively noticeable "rings" which are sometimes found particularly in round holes where the tooth of the broach always contacts the same spot in the part, and as each successive tooth enters it meets resistance and produces a jerky action. It is impossible to always have the same number of teeth in contact. For instance, if the pitch of the broach has a maximum of five teeth engaged, this means that at some time it has only four teeth engaged,

so that it may have alternately four and five. As each tooth contacts the entering end of the part, it meets with added resistance. This causes the jerk. The most effective method to overcome these rings is to stagger the pitch of the teeth so that they do not always contact the same spot as they successively enter the hole. It has been found most effective to have a succession of 3 teeth staggered. As an example we use $\frac{1}{2}$ -inch, $\frac{9}{16}$ -inch and $\frac{5}{8}$ -inch then repeat again with $\frac{1}{2}$ -inch.

In surface broaching this difficulty usually is not encountered, since, as explained before, both the part and a broach are mounted rigidly. However, if two or more parts are broached at one time on the same ram, or if several surfaces are broached on one part, it is possible that when *all* inserts contact the various points at the same time, it will cause chatter. Chatter is most prevalent when a machine is loaded to its maximum capacity. This difficulty can usually be at least partly eliminated by alternating the broach inserts, so that all points are not contacted at the same time. This method also varies the position of the teeth in contact through the entire length of the part. An angular tooth which produces a shear cut will also help to eliminate this condition.

* * *

What determines speed at which a broaching machine is to be run?

The governing factor which determines the speed of a machine is usually the material. Many types of steel can be broached very successfully at 30 feet per minute. Hardness is the primary factor here, although the finish required may also be a factor. Cast iron, brass, aluminum and similar materials can be broached at normal speeds such as 30 feet per minute, which incidentally is regarded as the maximum speed at which all hydraulic machines operate, since this appears to be the most practical from a standpoint of hydraulic equipment and motors. Hydraulic machines up to say, 15 to 20 tons capacity, can be operated conveniently and economically by normal equipment at 30 feet per minute. But speed of the machine depends on the volume of oil that can be pumped. The greater the speed, the greater the volume, motor capacity, pumps, and valves, that are required.

The volume of oil required to operate a 50 ton machine at 30 feet per minute would almost be impossible to obtain, so by reducing the speed to say 15 feet per minute the same h.p. capacity motor, hydraulic pumps and valves, can be used as for a machine of 25 tons capacity operated

at 30 feet per minute.

The material is not always the governing factor. For instance in broaching cast iron, which can normally be broached at a speed of 30 feet per minute, if the force required for a heavy cut necessitates a machine capacity of 40 or 50 tons, it can easily be understood by the above analysis that it would not be practical to build a machine of this capacity to operate at this speed. It should be designed to broach at approximately 15 feet per minute.

Since the finish can sometimes be improved by a slower machine speed, this fact should be kept in mind when broaching materials that are extremely hard, such as those encountered in the present war program. This may also prevent broaches from scoring, nicking or producing rough finish. The coolant is also a governing factor, not so much in speed but finish, which will be touched upon later.

To determine the correct speed then, it is necessary to consider the combination of the above elements. The most effective method is experience. An efficient operator, foreman, or set-up man can usually sense the maximum speed at which the machine can be operated for producing the results required.

* * *

To what extent does the speed of broaching affect stress on the broach bar?

Generally, the speed has no particular effect on a broach bar so far as stress is concerned, since the force required to pull this bar is governed by the step per tooth and the number of teeth in contact.

However, as each successive tooth contacts the part, it meets with resistance which creates a shock. The harder the material, the greater the shock, and it is only natural to assume that when a greater speed meets with a sudden resistance, the shock becomes more forceful.

The tensile strength of the broach must always be considered in connection with the force required to pull it. This is particularly true in small diameters where the nicking of the teeth produces a small root diameter. High speed will no doubt break a broach quicker than a slower speed, due to the shock as each successive tooth enters the part.

Should the same grade of grinding wheel be used for both rough grinding and finish grinding of teeth?

Cylindrical sharpening of a broach as it is first received from heat-treatment is done with a coarse-medium hard wheel to remove scale. Finish sharpening is done with a wheel of the same grain but with a finer bond. Polishing is performed with a real hard fine grain wheel.

Flats on surface broaches are sharpened with a fine grain medium hard wheel and polished with a fine grain hard wheel.

* * *

On resharpening, how fast should a good operator be able to finish grind a 2-inch diameter plain round broach of 50 teeth?

If a broach has already been in use it is difficult to determine the time required. Much depends upon the condition of the broach and how long it has been in use before sharpening. If the teeth are badly scored it will naturally require more time than if they are in good condition. It is also important that the broach be reasonably straight to avoid any whip.

It is also possible that it is necessary to make a special setup on a particular broach since the broach previously sharpened was of a different length and style. However, if all conditions are reasonably normal, and the condition of the broach is not too bad, a good operator should finish sharpen a broach in from 1 to 1½ hours.

* * *

How dull should a broach get before resharpening?

Resharpening broaches is a very important factor in their maintenance. The correct tooth form, cutting hook, smooth finish and proper sharpening equipment has much to do with the performance of these tools after resharpening. The form as received from the broach manufacturer should be maintained as closely as possible.

There are several ways which determine when a broach should be resharpened: (1) By periodic-

How can excessive drift of cut in cored cast iron be overcome?

This question always presents a very difficult problem. Various designs are in use. This difficulty depends largely upon the condition of the cored hole. Sometimes cored holes have an excessive and irregular taper. Some are oval shaped where they should be as round as possible. In extremely long parts they are excessively bowed. Some are materially off-center.

The most effective method to at least eliminate part of this difficulty, is to design a broach where the first group of teeth takes a heavy bite and cuts through the scale into clean metal. One main factor is to prevent cutting on the full periphery of a round broach. The teeth should be interrupted so that only sections of the teeth con-

tact the part.

This can be better understood if a spline broach is considered as an example. If a 10-spline broach is used, only 10 points are contacted. This will make it possible to take a real heavy step without excessively straining or loading the machine or broach. Several designs are in use such as the roto-kut, the side stepping tooth or the double cut broach. There does not seem to be any material choice. The main purpose is to bite into the metal with a deep cut, contacting only sections of the periphery with as narrow a cut as possible and working around this surface in a nibbling action. But most important of all is to hold the cored holes as nearly correct as possible.

There wasn't time to ask questions when Tool Engineers decided to make broaching tools and machinery do jobs that couldn't be done. They may find help toward increasing efficiency in these practical answers.

ally examining the part being broached. The finish will aid in determining when it should be resharpened. If the part commences to show rough surfaces or tears, it is a good indication that the broach needs resharpening. However, this procedure is not recommended. (2) The broach should be examined at regular intervals to check the cutting edge of the teeth. When the edge indicates a shiny land or a ragged edge, or perhaps a slight pick-up, the broach should be sharpened, since there is danger of breakage if the broach is used when extremely dull. The shiny land on top of the tooth is the best indication of resharpening. You can well see that the wider this land the more stock must be removed to bring the broach to a sharp edge and therefore it should not be allowed to become too wide. It is much better to sharpen more often and remove less stock, than to use it over a longer period, since it is then necessary to remove excessive stock on the face of the tooth and thereby shorten the life of the tool.

* * *

Does a deeper cut per tooth tend to overcome the powdering of cast iron which acts as an abrasive on the broach?

After the scale in a cored hole has been pierced, the broach will cut more freely and will not wear down the cutting edge as quickly as when breaking through the scale. Examination of a broach that starts from a cored hole will show that the front end that pierces the scale shows greater wear than the body of the broach that cuts the clear metal. However, since cast iron has a tendency to crush under a cut, a deeper cut per tooth will not ordinarily overcome this powdering, because as soon as the chips are broken away from the body of the part, they become "free agents" and crumble.

We all know that cast iron dust mixed with the coolant becomes an abrasive which has a great tendency to lap down the cutting edge of any tool. If this material can be broached dry, the tool life should be increased. However, dry broaching may not give the desired finish so that if finish is the deciding factor, tool life must be sacrificed. A coolant of soluble oil and kerosene seems to produce good results with the least amount of abrasive effect.

* * *

What is the maximum amount of stock that can be removed per plain round tooth? Per spline tooth?

The amount of stock that can be successfully removed per tooth is an open question. It is usually based on past performance. Where a combination round and spline broach is used, it is customary to equalize the surface in contact, so that the cutting force is as nearly constant as possible throughout the entire length of the broach.

On a plain round broach the surface per tooth is greater than a spline broach which is interrupted on the periphery. As mentioned previously, the broaching equip-

ment available is sometimes a deciding factor since the force must be held within the capacity of the machine. The material to be broached is also an important factor.

A free cutting steel will allow a greater step than a hard or tough steel. Cast iron will permit a greater step than a free cutting steel, and since the constant used for the determining force is less than for steel, the same machine capacity will allow a greater step.

The diameter of the broach is another factor that must be considered. Broaching force must be held at less than the tensile strength of the broach itself. This is determined by finding the area of the smallest diameter of tooth undercut. It has become more or less a standard practice, where the size of the broach will permit, to use a step of 0.002 to 0.003 inches, on round broaches and 0.005 to 0.006 inches per tooth per diameter on spline broaches as a safe step for free-cutting steel. 0.001 to 0.005 inches on round and 0.0035 to 0.004 inches per tooth per diameter for spline broaches on tough alloys such as high nickel and high chrome steels is recommended. Cast iron will permit as much as 0.005 inches per diameter on rounds and 0.010 inches per diameter on splines providing the broach can take it.

The length of the part being broached must be taken into consideration before determining the step per tooth, since the step clearance is determined by the pitch and depth of tooth. If this area is not sufficient to allow the steps mentioned it must be reduced accordingly.

* * *

Should the depth of the chip-breaking nick be specified as well as its width?

The depth of the chip breakers need not necessarily be specified, but it is very essential that the depth be sufficient to allow clearance at the bottom for the step from one tooth to the next. For example if the step from one tooth to the next is 0.005 inches it is necessary that the chip breaker be more than 0.005 inches deep. And since the depth is so slight, it is usually not dangerous for the chip breaker to be less than this step, because 0.005 inches would only be a scratch and could hardly be noticed. When the operator sinks his wheel you can be sure it is deep enough. However, one important factor in chip-breakers is to be sure that the breaker pierces the entire width of the land so that the heel of the tooth does not drag.

* * *

What is the best formula for determining the number and size of chip-breakers to use?

There is really no set formula for determining the number and size of chip-breakers. On spline broaches the width of the spline must be taken into consideration since it is important that the chip-breakers overlap. To be more specific, the chip-breakers must not follow each other in whole or in part from one tooth to the next. If a chip-breaker cannot be made to overlap by using a 1/32-inch wide wheel, some other method of breaking up the chip should be used.

In the case of round broaches, determine the entire circumference and divide this into equal parts so that the chip-breakers will be spaced approximately $\frac{1}{4}$ and $\frac{3}{64}$ inches wide. This practice is used under normal conditions and where the diameter of the broach will permit it. Special cases, such as broaching scale in cast iron, must be considered in accordance with the individual problem.

* * *

Is a reduced hook angle on finish teeth advantageous?

A reduced hook angle is of no advantage on finish teeth. On the contrary, it is dangerous. After a broach has been in operation for some time and sharpened several times, the outside diameter is gradually reduced due to the back off on the outside diameter. Considering this factor the first finish teeth will then be required to cut and if they do not have the proper cutting hook you cannot get the results required. The back-off can be reduced on the finish teeth so that the outside diameter does not lose its size so quickly, thereby giving better tool life.

* * *

What is the normal amount of stock to remove from a roughing tooth when regrinding? From a finish tooth? How can it be determined when all the finish teeth need regrinding?

(A) Roughing Teeth — It is difficult to state the exact amount of stock to be removed by sharpening since this depends upon the condition of the broach. If the broach has been used over an extremely long period between sharpenings, it will of course be necessary to remove more stock. This is true, also if the broach has been nicked on the cutting edge. Under normal conditions we would say that to remove 0.010-inches to 0.015-inches stock should be sufficient.

(B) Finish Teeth — It is evident that it is necessary to remove more stock from the first and second finish teeth than from the succeeding teeth, so that the stock removal would vary from approximately 0.010-inches on the first finish tooth to not more than 0.005-inches on the last tooth.

(C) All Finish Teeth — We make it a general practice to touch up all the finish teeth in resharpening, since invariably the teeth show a shiny surface due to dragging through the part. As mentioned previously, the amount can be determined by the width of the shiny land which should be entirely removed.

* * *

How much experimenting with cutting lubricants is warranted on each job that comes up which does not have as good a finish as is desired?

The cutting lubricant used in broaching is very important in producing satisfactory results. This is true regardless of what material is being broached. Usually, any shop that does a lot of broaching has made many experiments either on its own accord or through various suppliers of coolant oil.

If a part has not previously been broached and satisfactory finish is not obtained, first examine the broach to make sure that it is in A-1 condition and that the proper

rake angle is used. A comparison of material should be made with that of some other part which has been satisfactorily broached. The same coolant should be tried as for the material nearest to the specifications for the part in question. For most all steels and brass or bronze any good grade of sulphur base oil will give a satisfactory finish. For cast iron, a mixture of kerosene and soluble oil gives good results.

It is difficult to state definitely how much experimenting is warranted since the finish produced in one plant may not pass inspection in some other plant, so it is really an individual problem.

* * *

To what extent does the proper selection of the cutting fluid increase the life of the broach bar?

The principal functions of an oil or compound as applied to metal-cutting tools may be briefly summarized as follows: (1) to carry off the heat developed in separating the chip from the work, thereby preventing dangerous rise in temperature through the accumulation of such heat; (2) to lubricate the chip as it slides over the tool or the work, and thereby reduce the generation of frictional heat. (This applies more especially to the cutting of steel); (3) To improve the finish of the work; (4) To increase the durability of the tool; (5) To flush out the cutting area, and wash out the small chips.

You can readily determine from the above requirements that a proper lubricant is very essential. Just how much the life of a broach is increased is difficult to state definitely. However, if proper coolant is not used the chips will weld and gall on the cutting edge of the broach. If this condition continues excessively, the cutting edge will break down more rapidly, thus necessitating sharpening more often. The more a broach is sharpened the shorter the life, and that under really bad conditions the decrease in life could be as much as 50%.

* * *

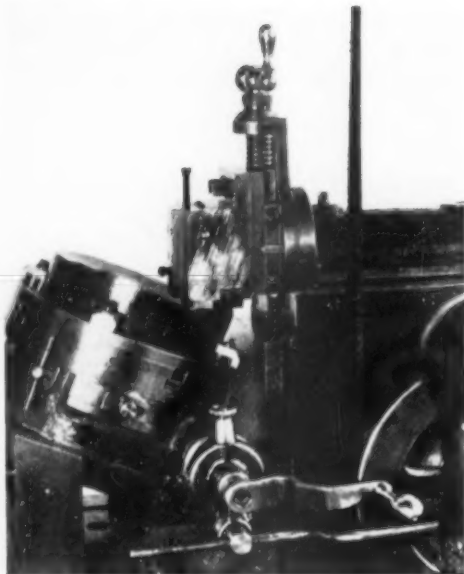
When broached horizontally, how heavy should a piece be before its weight is supported by a fixture?

The weight of the part is not always the deciding factor in supporting a part in horizontal broaching. Some means of supporting the part regardless of weight is recommended. The weight of the broach itself is sufficient to cause sagging.

All that is required on smaller parts, especially those that have a hub construction, is a face plate with a counterbore sufficient to keep the weight of the part and broach on the center-line. Unless some such arrangement is used it is very difficult to locate the exact center-line of the broach ram, and if the broach is not pulled on center there is a danger of breaking the broach, or creating an angular condition in the hole.

Then, of course, as the parts become larger and heavier, it is necessary to provide better and more positive means of support. Therefore, it is advantageous to provide *some* means of support regardless of how small the part may be.

Applied Tool Engineering



Right, fixture, master cam finished parts and tool bits.

Left, fixture is mounted on rotary table clamped on apron of small shaper. Replacing shaper clapper box is a special head carrying tool bit and tungsten carbide cam follower.



Radial Shaping

Robert E. Dow, Scott & Williams Knitting Machine Co.

A part known as a sinker cam used in the manufacture of knitting machines is produced by an interesting method.

The part, a tool steel ring formed on one side in the shape of a cam of different heights and angles, is held to .001-inch accuracy.

The rough machined blank part is located in the center of a fixture upon which is mounted a hardened master cam twice the diameter of the work and accurately machined to the same contour as the finished part.

The fixture is mounted on a rotary table clamped on the apron of a small shaper. In place of the clapper box of the shaper, is a special head carrying a tool bit and a tungsten carbide tipped cam follower. This head is held against the master cam on the fixture by a strong coil spring.

As the machine runs, the follower, resting at all times on the master cam guides the tool bit in the proper path to reproduce the cam surface on the work.

The rotary table is operated from the regular feed mechanism on the shaper and is reversible to allow rotation in either direction. By reversing the rotation for each piece, the tool bits and cam followers, which are ground with a thirty degree angle on each side, will last longer and wear evenly.

The same method is used to back off the part to leave a narrow cam surface except that the rotary table is tilted at an angle of twenty degrees and the master cam, which is tilted with the fixture, is cut at the same angle.

This method has been successfully used to produce cams of various shapes and sizes.

Negative Rake

THE functions of cutting tools—to cut, dissipate heat and clear chips—are generally covered by rules of design and application. For instance, tools should be heavy enough, with the bias on oversize, and adequately supported under the cutting edge. These rules, however, are flexible and do not too strictly limit design. Rather, they cover broad applications, from conventional forms to radical departures, and offer considerable latitude within which one may obtain the best cutting performance with corresponding economy.

This general introduction is for the benefit of our younger Tool Engineers, many of whom are inclined to restrict themselves in the design and application of cutting tools. Yet, it is generally conceded that one does not cut brass or copper with hooked or positive rake tools, nor does one drill either metal with a conventional twist drill without first flattening the lip, especially if the hole is to break through. To each metal, or material, and to each application—as turning, facing, boring or milling—the composition and form of tool best suited to the job to be processed should be used.

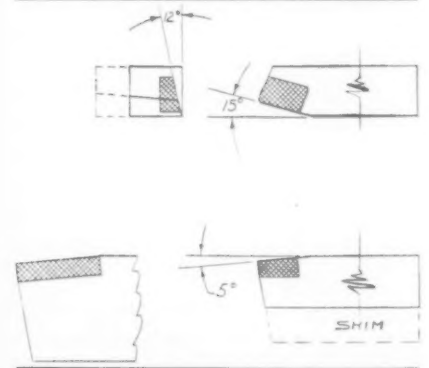


Figure 1

And, in deciding on the tool, one may well give due consideration to *negative rake* which offers many advantages over conventional forms.

Negative rake is exactly what the term implies—the reverse of positive. It's not particularly new, having been employed, by accident or design and

with varying degrees of success, over a period of years. But the cut-and-try era of Tool Engineering has given way to science, and modern cutting tool experts have reduced negative rake to scientific formula.

Figures 1 and 2 show the modifications from conventional, the one leaning toward the extreme while the other tends more to the conventional. Actually, the first was a cut-and-try, to recommendations, and proved a

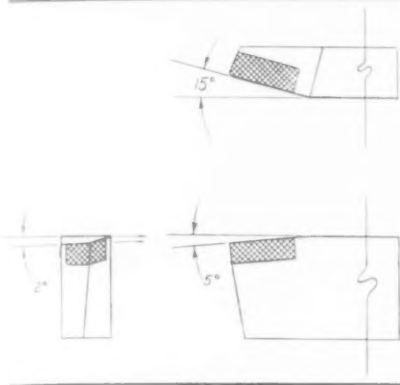


Figure 2

thesis although the tool itself was too light to stand up under a heavy cut. Hence the later reinforcement, shown in dotted lines. A stock tool was modified, but it is poor practise to grind away valuable composition besides which reduction of carbide body restricts dissipation of heat. Mill the holder to the required angles, as shown in the supplementary sketch. As shown, the first tool has a negative rake of 15° , with 12° side rake, 15° side cutting edge angle and end cutting angle 8° or 23° from center line of tool. Front relief of 8° is shown, although a secondary front relief should be included.

While shown for turning, negative rake can be employed for boring as well, and for milling, when complementary angles will have to be plotted accordingly. Negative rake is not a cureall—even its most enthusiastic exponents concede its limitations. But within those limitations it permits of considerably faster speeds and feeds, with a marked reduction in cratering and, consequently, longer tool life with less grinding.

A New Type Draw Die

John Sarnecky, General Electric Co.

Confronted with the problem of producing the part shown in Fig. 1, tests proved that this part could not be produced with the conventional type of draw die, because material accumulated on the forty-five degree surfaces as the drawing operation progressed.

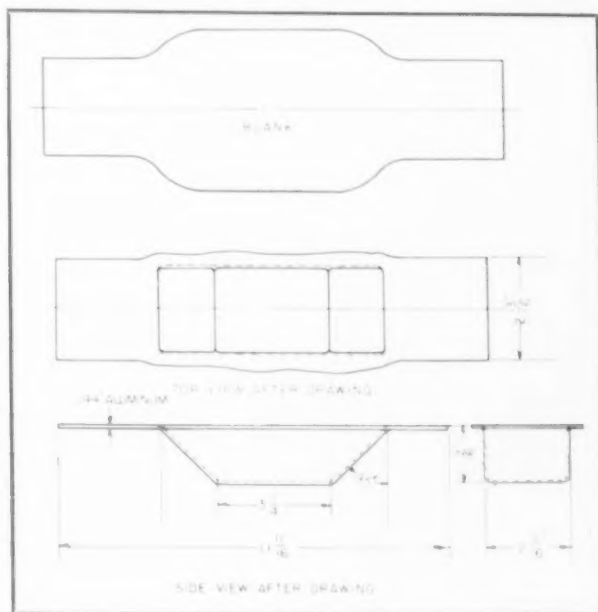


Figure 1 shows the part to be produced. Using conventional drawing methods, the material tended to accumulate on the 45° angle.

A new type of draw die, illustrated in Figure 2, was developed to produce this part. This die features the application of two spring-backed, sliding members which "iron out" the forty-five degree surfaces while they are being drawn by the descending punch. Accumulations of material, wrinkles, and breakage are thus prevented.

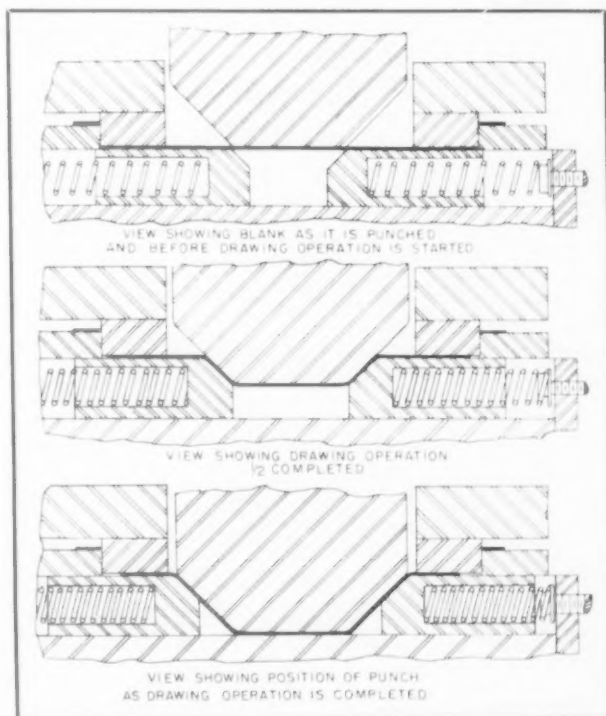


Figure 2 shows the new type of draw die which "ironed out" the wrinkles in the material.

Sharing 'Know How'



Tool Engineers turn parlor trick to advantage in stamping production

Compressed Air Film Doubles Stamping Production

STAMPING production is doubled and rejects are cut down considerably in punch press operation by the simple expedient of blowing air down through a $\frac{1}{4}$ inch hole in the upper die. When the air is shut off, the stamping falls into the hand of the operator thus eliminating scratches and the necessity of prying it loose from the lower die.

The solution was found in the application of the inverse relation of air pressure to velocity, such as used in the simple trick of trying blowing on a piece of cardboard under the end of a wooden spool. The cardboard disc with a pin through it to prevent side-slip is placed over one end of the spool, and no amount of blowing through the other end can blow it away even though gravity would seem to let it drop. The air leaving the spool at high velocity strikes the disc and escapes between the spool and the cardboard. The escaping air must overcome inertia and friction and this causes a reduced air pressure on the spool side of the disc. Result is a balance of atmospheric pressure against gravity such that the disc "floats" on a plane very close to that of the spool.

This idea was applied to the problem of removing the stampings. An 80-pound air line was connected to the press, and air blows through a $\frac{1}{4}$ -inch orifice drilled in the upper die. Air pressure is applied and controlled from the crankshaft simultaneously at the start of the up-stroke of the stamping motion. When the stamping operation is completed, the reduced atmospheric pressure above the metal piece causes it to rise with the upper die. The air pressure is then released, and the plate drops into the hands of the operator.

To Speed Production

Simple and ingenious shop tricks to save production time and cost.

Drilling a variety of holes: For more accurate drilling, and to prevent drill from breaking, bushings held in a fixture attached to V-block will accurately guide drills of from $\frac{1}{4}$ to $1\frac{1}{4}$ inches. Jig holds stock up to four inches long. Bushings are interchangeable. Tightness of twist can be controlled by setting of collar behind spring.

Removing broken stud or tap: To save time and material, and to reduce scrap, a nut is welded on the tool or stud. The nut, same size as broken piece, is filled with welded metal to make a solid unit. Flux from welding rod prevents "freezing" to casting surface. Successful in removing taps as small as 4-40. Practicability depends on cost of casting.

Drilling a square hole: To save time and insure more accurate drilling, place the work under a cylindrical guide, with square hole in top. After boring hole through piece, use a triangular cutting tool to follow the contour of the square guide. Drill press or lathe is used to rotate special chuck.

Reclaiming worn boring bar pilots: For a quick repair job, and economical long service—Four pads of hard facing electrodes are arc welded to worn pilots. Deposit is ground to required diameter. Low portions between welds provide chip clearance and aid operation. This is useful when the diameter of the pilot is sufficient to allow for the necessary machining to accommodate the hardened bushing without interfering with the set-screw.

Opening cotter pins: To save time and speed production, grind small diameter heat-treated steel bar stock to resemble screw driver blade. Cut out, leaving two prongs. One prong is rounded to fit eye of cotter pin; other prong flattened to facilitate opening of pin.

Magnetism Detects Under Surface Flaws

HEAT treated parts—like bearing races and similar cylindrical objects—are being inspected for under-surface flaws by a simple magnetic method developed by P. H. Brace and C. S. Williams of Westinghouse Research Laboratories. In addition to speed and accuracy, this electromagnetic test for flaws requires no contact with the inspected part and performs its task without marring or denting polished surfaces.

When a symmetrical piece of steel is properly heat treated and then magnetized, the external magnetic field is uniform. However, any defect in the heat treatment such as a hard or soft spot changes the permeability of the faulty region and the magnetic pattern. In actual testing, the heat treated part is first demagnetized completely to wipe out all traces of residual magnetization. The piece is next rotated at high speed, and at the same time strongly magnetized, so that flux extends outward from the surface being tested. Finally this flux is explored with an electromagnet consisting of an alloy bar surrounded by a coil. Only variations of the magnetic field induce a voltage in the coil, which is amplified and indicated by means of oscilloscope. The test piece is rotated synchronously with the cathode-ray sweep, so that a uniform field is traced on the tube screen as a luminous straight line, but faults show up in the oscilloscope trace as dips. A second trace on the tube screen acts as a reference line and carries twelve index points, corresponding to 30° angles around the test piece. By this means a fault can be spotted on the periphery within a few degrees.



Although the oscilloscope affords only a visual indication of the fault, it is possible to add a relay system to give an audible signal by means of a bell or buzzer, or even to operate automatic machinery for segregating defective pieces coming from a production line.

To Help the Nation's Small Industries

Recognition of the value of the nation's technical press to the war effort was demonstrated by the Westinghouse Electric and Manufacturing Company last month. At an elaborate editorial luncheon in New York City's Hotel Astor, the company revealed more than a score of new engineering developments and ideas that may be utilized in speeding production. Editors of *THE TOOL ENGINEER* attending the conclave gathered as most significant the stories presented on these pages.

Keynote of the meeting was revealed by Dr. A. A. Bates, director of chemical and metallurgical work at the firm's research laboratories. "We believe this demonstration illustrates the willingness of many big companies to share their specialized 'know how' during this national emergency . . . so that these new techniques can be put to use in the thousands of small factories which are working day and night on war production."



Brazed Strippers Lengthen Die Life . . .

THE life of metal stamping dies is increased and the quality of stampings is improved by a simplified method of making die strippers. Other advantages include, stripper accuracy equal to that of the die and a manufacturing cost of 1/3 to 1/15 that of the old conventional method.

A stripper has an important bearing on the overall performance of the die. For example, in making motor laminations, the clearance between the punch and the die is usually in the order of one-thousandths of an inch and the stripper must fit almost as

accurately as the die itself. Formerly the stripper was made of one piece by laying out, jig boring, sawing, and hand-filing the slots. Such operations have the hazard of causing non-uniform clearance in slots—a factor that hastens the wear of the die.

By the new method, a disk of the proper grade of tool steel is machined to the outside diameter of the slot edge, and equidistant slots are cut on a milling machine using a ground form cutter. An outer ring is shrunk to the milled piece and copper brazed in controlled atmosphere furnace.

Optical Glass for War

Canada Speeds Manufacture

STIMULATED by increasing demands placed upon it by the Allied war effort, the optical glass industry is now using numerous time-saving tools in the production of both metal and glass parts of such important military and naval materiel as telescopes, range finders, and periscopes.

Recent achievements by the Research Enterprise Ltd., a Dominion-Government owned concern, are particularly noteworthy.

Quantity production is attributable directly to wartime demands, and has been achieved by the application of new tools. Although similar designs and adherence to tolerances are necessary in the construction of microscopes, expensive cameras and binoculars, the volume of goods demanded became so great that it was necessary to develop new spindle machines. In this work, Tool Engineering played an important role.

Properties of Glass

To fully appreciate the application of production methods to the manufacture of optical glass, some understanding of its physical properties is necessary. Optical glass must be extremely transparent. Though bubbles are not objectionable in extremely small quantities, there must be no striae (streaks), and its index of refraction and dispersion characteristics must be controllable.

The glass is broken first into lumps by hammer, care being exercised to select pieces free from streaks and impurities. These pieces are further separated with rubber bonded silicon carbide or diamond wheels. This method is replacing the older use of a carborundum and water abrasive. Wheels may be .040" thick and turn at 7,500 feet per minute. The glass is removed at the rate of approxi-

**From a Talk by Dr. D. C. Jones,
Technical Director of the Optical
Div., Research Enterprises Ltd.**

mately one square inch per minute.

For use in lenses, pieces of proper volume are heated and pressed roughly in a mould, leaving 1/32 to 1/16 inch to remove. The pieces are then carefully annealed.

Application of simple production methods is made in grinding operations. Grinding is performed with the blanks mounted in a cluster, set in wax or pitch. A 10 inch diameter head may carry sixty or seventy pieces. Removal of the material in the roughing stages is relatively fast. The speaker's theory is that the glass is not removed in the form of curls, as is generally the case with metals. The theory is that, the abrasive builds up a concentrated pressure which finally smashes off a chip, so that the roughing is obviously a different process to the final polishing.

On a 22 inch disc, using 80 grid abrasive, the work may turn as fast as 300 revolutions per minute. Flat surfaces are ground on an ordinary surface grinder with diamond wheels. A cut .010" deep is taken with a table feed of 12 feet per minute. For finer grinding, elements may be set in wax, resin, or shellac, on a steel plate, which is held to the grinder in a magnetic chuck. The operation, in effect is one familiar to all machine shop workers.

Emery and Rouge Used

The distinctive aspects of optical glass finishing come in the polishing and finish operations, in which dependance is not placed on the machine because of excessively fine limits. A floating lap is used, and the judgment of the operator becomes the

only control. Fine emery is used for polishing, and the final lapping is done by rouge, held in felt or pitch surfaces.

The finishing operation is comparatively slow, requiring 25 to 30 minutes on small lenses, and as much as 10 hours on large ones. The accuracy of grinding is tested by interference fringes. In a prism the surface must be flat within one-quarter of a wavelength of light — approximately .000005". In lenses, greater departure is allowed in the dimension, but the surface must not depart from that of a true sphere. The angle of a prism, if it is to be 90°, must be accurate within plus or minus 3 seconds of angle. This correction is made by hand and checked by telescope.

Finishing of Lens

In one operation of particular mechanical interest, the exterior diameter of a lens is ground, and must coincide with the optical axis. For this, the lens is set in pitch temporarily softened while in the chuck of the lathe. A beam of light is shone through the lens, on to a mirror, returned through the lens to another mirror. When the spindle is turned, the reflection of the beam of light will show movement unless the lens is accurately centered. After the correction is made, the pitch is chilled and the outside cylindrical part of the lens ground so that it will fit accurately in its cell.

One of the most difficult operations in the manufacture of these instruments is the preparation of the graticule, due to the difficulty of producing rules accurately spaced and located. These rules are not more than .001" wide. Since these lines and accompanying figures are in the optical plane of the instrument, any inaccuracies are enormously magnified.

Tool Engineering DATA SHEET

10 Points about Molybdenum High Speed Steels

Knowledge of moly high speed tool steels is fast becoming a "must" for the average Tool Engineer. This chart is designed to answer many of the questions about substituting moly steels for hard-to-get tungsten high speed tool steels.

Excerpts from a talk
by Burns George, Vanadium
Alloys Steel Co., Pittsburgh

1. Types of Molybdenum High Speed

There are many variations in the composition of moly high speed steels, dependent on the manufacturer. The four types shown here are prone to decarburize during hardening and forging because of the molybdenum content. Type D is characterized by high wear resistance, due in part to its higher carbon content. Where it is desirable to increase red hardness and cutting ability, cobalt additions are possible, although few moly-cobalt steels are available as yet. (A complete article on molybdenum steels appeared in The Tool Engineer for February, 1942.)

Type	C	W	Cr.	V	Mo.
A	0.85	...	4.00	2.00	8.00
B	0.80	1.50	4.00	1.00	8.50
C	0.80	6.00	4.00	1.50	5.00
D	1.25	5.50	4.50	4.00	4.5

2. Disadvantages of Moly High Speed

- (a) A pronounced tendency to decarburize when heated for hardening or forging. Protection of the piece being hardened or forged with borax or special copper paint is recommended.
- (b) Moly high speed is difficult to harden. There is no

easy means of determining when the pieces being hardened are up to heat. Moly high speed does not "sweat" like an 18-4-1 type, and as a result, overheating with consequent grain growth and cracking often occurs. Lower cost of moly high speed is a point in its favor.

3. Factors Affecting Tool Life

- (a) Design.
- (b) Heat treatment—proper hardness.
- (c) Heat conductivity—conduction of heat away from the cutting edge.
- (d) Hot hardness—a comparison of the hot hardness of moly and 18-4-1 types of high speed steel at 1200° F., gives the results as shown in the table. The tools in question were first hardened and drawn to a Rockwell "C" hardness of C-65.

Hot Hardness at 1200° F.

Type A	313 Brinell	Rockwell "C" 32.2
Type C	342 Brinell	Rockwell "C" 35.9
18-4-1	312 Brinell	Rockwell "C" 32.0
18-4-1	344 Brinell	Rockwell "C" 36.2

4. Selection of Moly High Speed Steels

High Tungsten Type	Moly Substitute
18-4-1	Type B
	Type A
	Type C
18-4-2	Type C
	Type D
18-4-1 plus Cobalt	Type D

Tool Engineering Data Sheet - 10 Points About Molybdenum High Speed Steels

5. Heat Treatment

A preheat for all types of moly high speed is imperative. Preheating temperatures as a rule are about 100° F., lower than for the high tungsten types. A soak at this temperature is advisable. Heating to above 2200° F., before quenching is not recommended.

All moly high speed tools should be cooled to room temperature before drawing. The recommended drawing temperature is 1050° F., giving a Rockwell "C" hardness of 65. The recommendations of the various manufacturers are, however, more reliable than this figure. It is advisable to aim for a hardness from 1 to 1½ points higher than the hardness aimed for with the high tungsten varieties of steel.

6. Protection of the Surface While Heating

Borax is satisfactory but is very hard on furnace hearths. A special copper paint is excellent. Best results are obtained if it is sprayed on the piece to be heated. A little experimental work to determine the correct thickness of coating for a particular heating cycle is desirable. The

Intermittent drawing, that is, a draw for two hours, cooling to room temperature, followed by another draw for two or more hours is much superior to a single four hour draw. This is because structure and, therefore, physical characteristics resultant from a drawing or tempering operation, do not occur at the drawing temperature, but during the time interval when the piece is cooling from the drawing temperature. Internal stresses are set up due to carbide precipitation as the piece cools and a further draw results in relief of these stresses with a corresponding increase in toughness and resistance to shock, although the hardness should not materially change due to this second draw.

coating should be of such a thickness that it is all burned off at the completion of the heating cycle. A mixture of hydrogen peroxide and aqueous ammonia may remove any residual coating.

7. Annealing for Re-Hardening

Pack in fresh cast iron chips and heat to 1400-1450° F. This temperature will not fully anneal moly high speed but will serve as a stress relief and if this is accomplished, cracking and grain growth will not be encountered on re-hardening.

Stress relief should be accomplished in about four hours

after which it is permissible to transfer the hot piece, immediately, to the heat treat furnace for re-hardening or allow it to cool in air for hardening after a time interval. If a full anneal is desired, pack in sand to which has been added 1% charcoal (not lamp black) and heat to 1550-1600° F.

8. Grinding

Types A and B are a little gummy and require a softer wheel. This is due to a soft matrix found in these types. Type C variety can be ground with wheels used for 18-4-1

types. The high carbon Type D is difficult to grind and will require about 1½ times as long as the other types.

9. Movement Resulting from Hardening

0.001—0.0015" per inch is an average figure. Avoid over-heating.

10. Machining

Tool bit angles will generally have to be more acute to permit easier chip flow.

NOTE: On this and the preceding page is the tenth of a series of Data Sheets to be published in THE TOOL ENGINEER. A handy three ring binder can be secured at any dime store to hold the sheets for quick reference.



*I*deas for **VICTORY**

...from the Production Lines
behind the Firing Lines



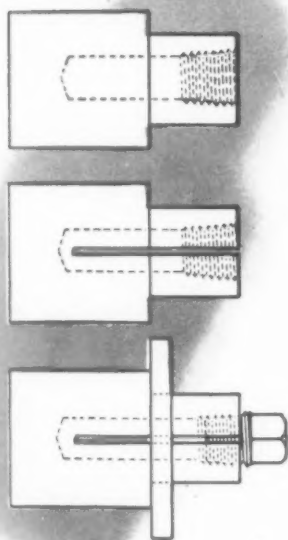
He Didn't Wait for a Tool Room Arbor!

J. H. Medling, with the Aro Equipment Co., Cleveland, developed a relatively simple plug to hold small diameter washers quickly and accurately without losing valuable time waiting for a special arbor to be made up in the tool room.

The accompanying drawing shows operator Medling's "Idea for Victory"—an idea which may be helpful to other operators.

Many operators are resourceful and ingenious in finding ways to produce more finished pieces on their turret lathes.

Many of these ideas are sent in by operators, to be published in "Blue Chips," a timely shop bulletin mailed regularly to turret lathe operators on our list. Are your turret lathe operators getting Blue Chips? If not, we will gladly send it to their homes.



One suggested method for holding second operation work, requiring location from the bore: A piece of stock is turned, slotted, and tapped with taper thread. Work pieces are loaded on this plug. A pipe plug is then used to expand and tighten the arbor against the internal diameter of the work piece.

**YOU CAN TURN IT BETTER,
FASTER, FOR LESS...WITH A WARNER & SWASEY**

**WARNER
&
SWASEY**

Turret Lathes

Cleveland

STARRETT HACKSAWS

IF YOU HAVE BEEN USING HIGH SPEED STEEL BLADES...

Recent government regulations have greatly restricted the supply of 18-4-1 High Speed Steel available for hacksaw blades. To users of this type of blade, we suggest Starrett S-M Molybdenum Special Alloy High Speed Steel Blades as an effective substitute. These tough, fast-cutting blades were developed by Starrett for cutting hard alloys and for metals hard to cut with ordinary blades. In life, performance and all-round cutting ability, they come close to matching 18-4-1 High Speed Steel Blades and because of their lower cost are actually more economical. Convince yourself that Starrett S-M Molybdenum Hacksaws are the blades to use for the duration. Order a trial supply from your mill supply dealer today.



THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U.S.A.
World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Larson's Luck

Holds

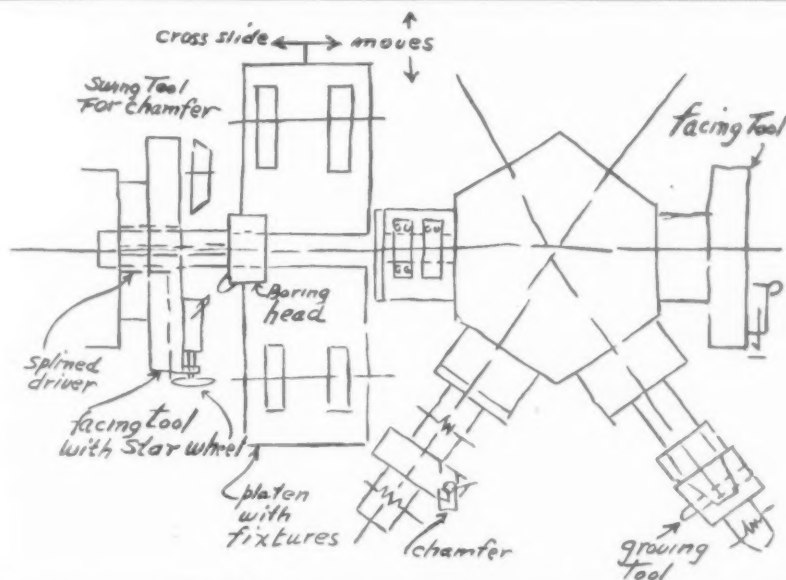
by ANDERS JANSSON

WHEN I first got to know your editor, sometime in '34 I told him a story about one Lars—Larry for short—Larson, and he asked me to pass it along to you Tool Engineers. Which I did, titling the story "Larson's Luck". I ran across Larry again

"We-ell . . ." I began, but changed my mind. Anyway, it was barely noticeable. "Er—perhaps you were too good an engineer to be taken from the home front".

"Yeh, they hinted something like that and of course I'm practical, like

Larry's savings, such as he'd accumulated after losing his shirt (he said pants) during the depression bought him a fair miller with a dividing head, a couple of lathes that looked bad but shrewdly purchased because of good spindles, a planer, a universal tool



Lars, showing how he set up his turret lathe, sketched on a paper napkin as he talked. "I couldn't swing the job on the machine, and it was so awkward it would have been a tough job balancing it, even if it would have cleared the interferences. Here's what I did." Anders Jansson relates what Lars told him—a story of real Tool Engineering.

just after the episode at Pearl Harbor.

After a bit of Scotch oil and mutual compliments on retention of youthful zip, the talk turned to war production. "Me, I'm right back where I left off in '19, running a small shop." Larry said. "You see, they wouldn't let me get into the last big argument, but whether on account of flat feet or a square head they never said. Anyhow I ain't got no accent any more, you notice".

most Tool Engineers. But I can shoot, too. You should see the time in the old country when I knock down two ducks . . . well, what are you laughing at?"

"Skip it." I said, having heard it before. "It's all right, it's still two ducks. But tell me about your shop".

"Oh, it's just another alley shop, nothing to brag about". Larry gestured disparagingly. "But I'll tell you about a job that almost broke me".

grinder and several drill presses along with a miscellaneous assortment of handies.

In addition, he'd bought on speculation a big turret lathe that had been built for a special job toward the close of the last war, and hardly used. "For a while, I thought it was going to be a white elephant, but it turned into a useful animal after all", chuckling. "Besides, I had accumulated quite an assortment of small tools—oh, enough

★ ★ ★

Lars Larson returns to The Tool Engineer after eight years' absence. He says he's lost his accent, but he's still deep in Tool Enyin—Engineering. This story of how he stepped up war production shows he's kept his knack.

★ ★ ★

“WELL, I studied that job plenty, believe me, and I finally hit on a scheme to lick it. Then I moved the turret lathe out into a brick garage back of the shop, where we could work in secret, and put the kid in with it. ‘There you stay, to atone for your sins’. I told him. ‘And

equipment for anybody to go to town with if he's got the stuff”.

LARRY started for “town” right away, having acquired something of a reputation along with his experience, at first getting the overflow of tools and fixtures from nearby prime contractors. “Only, some of ‘em were awful”, he confided. “Some of the designs you could make better using your feet instead of your hands. Not that I blame anyone, y’understand, what with the shortage of tool enyin—uh engineers. That’s where your Society’s doing a swell job, training young fellows for designing if they don’t get spoiled for other work when the war’s over. But maybe not from the way they try to get shop experience. Now I had a young fellow—”

“Sure, sure,” impatiently. I didn’t want him to ramble. Then, to the waiter. “Two Scotch and sodas”.

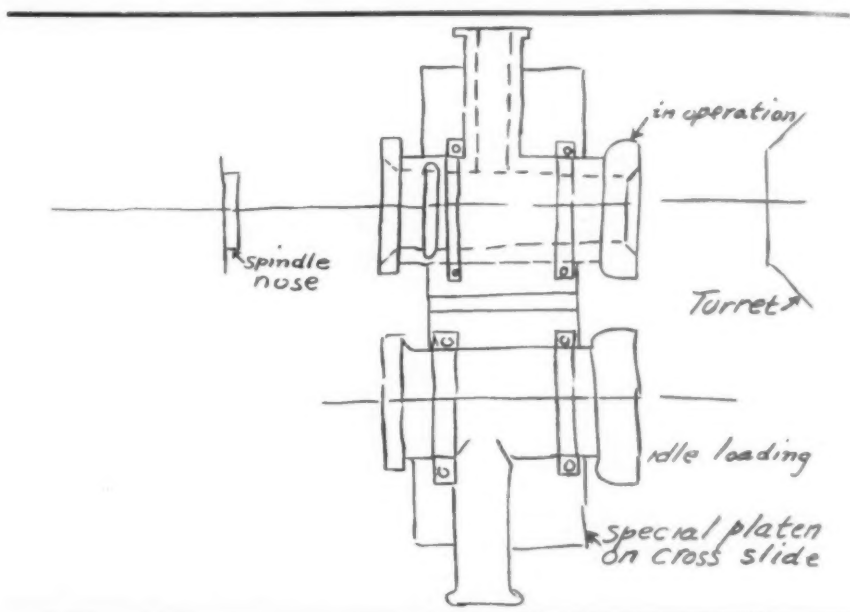
But Larry protested. “No, it’s my treat. Make it two beers”. Then, over the foam. “As I was saying, I had a young fellow just out of school, and he took hold so good I started training him in contact work. ‘What I want’, I said. ‘Is production work for that big turret lathe. See what you can dig up’”.

Larry shook his head. “Oh my, what a mistake I almost made! He came in one night, all tickled pink, and spread out a set of prints. ‘Look, Mr. Larson, a production job for that turret lathe! I’d told you before, only I thought I’d surprise you’. ‘It’s a surprise, all right’. I said. ‘You know darned well we can’t swing that job in that machine. Take the prints back and tell ‘em you’re sorry’.

“‘Oh, but I can’t do that!’ he said. ‘I told them you could do anything. Besides, I—I signed for it’.

“‘So what?’ I says. ‘You know dam well you ain’t got no authority to sign a contract’.

“‘Ye-es, but they don’t.’ He was looking pretty blue by then, and I felt sorry for him. But business is business, and that job was a Jonah if ever



Lars' sketch shows how two fixtures were used on a cross slide. He loaded the idle one, while the other was in operation. Saving time like this helps win the war.

one was. ‘Anyway, I know you can do it, and look, Mr. Larson, it’s for the duration’.

“‘That’s the hell of it’. I told him. ‘In the first place, we won’t endure long if we take it, and in the second, I know those birds. They farmed that job onto an innocent because they’re stuck themselves, I’ll bet, and as soon as they see us turning ‘em out they’ll copy our methods and pull the job’.

“‘You’ll take it then?’. But I said. ‘No, we won’t take it. But tell me, as long as you signed for it, what did you agree to do it for?’ When he told me, I got madder’n hell! “Thirteen bucks! Why, the dam fuzz pirates, taking advantage of a kid. I’ll show ‘em!’ And you know, right then I make up my mind to take that job... all right, if you insist. Make mine Scotch and soda. Well, here’s skoal!”

“Uhu”. I grunted. Beer when he treated, Scotch when it was my turn. Oh, Larry’s a shrewd business man. “Well, go on. What happened?”

listen. If we come out with a whole skin you get a raise, but if we don’t then, you look out’.

“‘Don’t worry, he said, ‘We’ll lick it’. ‘We!’ The gall o’ the young squirt! But we did lick it, the kid sticking like glue. Oh, I tell you, he’s a fine boy! Now what you laughing at? Oh well, you can’t hold a mistake against a kid. We had to learn and maybe the hard way’s the best. But let me tell you.

“Like I said, we set up the turret in the garage, and all the time the prime contractor had his men snooping around — you know how small shops are, wide open to your customers although you keep others out.

But I fooled ‘em’. For camouflage, I horsed that job around in my big lathe—it’s a 36-inch—and when they saw me looking worried like they shook their heads and felt sorry for me. “‘Afraid you can’t do it, Larry. Why, we did better’n that right in our own plant’. ‘Like hell you did, and

(Continued on page 120)

Magnetic Inspection

Patented in 1919, mossbacks predicted it would have little practical use. Developed and improved upon, here's how industry uses it for production inspection.

H. W. Stowell, Mechanical Engineer

THE inspection method for locating cracks, inclusions, strains, discontinuities and hard spots in metal parts that can be magnetized has revolutionized inspection in airplane, automotive, railroad shops and other manufacturing plants. It is based on the phenomenon that as a magnet is divided into parts, each part becomes a magnet, with opposing poles. The weak points for which inspection is being made have the effect of dividing a large part which has been magnetized into smaller magnets, setting up individual or distorted flows of magnetic current within the part being tested. Upon this phenomenon, depends the whole idea of magnetic inspection.

The magnetic method of inspecting turbine blades, one of the first uses of this method, was of special value because of the expensive damage of blade failure on a high speed steam turbine. A large turbine rotor has about 6,000 blades. Failure of any one of these would wreck it.

A tank of compressed oxygen used for welding has a pressure of 2,000 pounds per square inch at 70 degrees F. when full. Magnetic testing is a valuable safety precaution in connection with such high pressure containers.

The method of studying magnetism by the use of iron filings, to show the distribution of the lines of force, or magnetic flux, goes back to Faraday (1791-1867). This experiment of sprinkling iron filings on a piece of paper or glass over a magnet is a familiar high school physics experiment.

This experiment has been turned to practical use in inspection by creating electro-magnetism in a part to be tested.

Electromagnetize the part

An ordinary electro-magnet is made by surrounding a soft iron core with a magnetizing coil. When one or more loops of testing cable are placed around a magnetizable part and the current switched on, the metal part becomes an electro-magnet. Lines of magnetic flux run parallel to the longitudinal axis of the coil so that a coil placed around an axle or piston rod will magnetize it favorably for locating transverse cracks.

The cracks or defects tend to reduce a large magnet to two or more smaller magnets, as mentioned earlier. Iron filings, or powder, made especially for testing, sprinkled on the axle will gather about a crack to bridge it, like the "keeper" or armature of a toy magnet.

This method of inspection will detect defects when covered by scale, or in many cases defects beneath the surface of the metal. The painstaking search for cracks in pins, axles and crankshafts is avoided.

However, if the plane of the crack, or defect is parallel to the lines of

magnetic flux, there will be little distortion of the magnetism and no effective indication will be produced.

Powder used for dry test

Iron filings or powdered mill scale (iron oxide) were originally used as powder for sprinkling on the suspected parts to detect cracks. Several unexpired patents cover improvements in the powder. In general, powder used for crack detecting may be made of any paramagnetic material and should be finely ground. The powder offered commercially for dry use generally consists of particles coated with zinc oxide. Preventing metal to metal contact, particles do not become magnetized and cling together. The coating offers a smooth surface so the particles flow readily over each other and the surface being tested, and freely align themselves under the influence of the magnetic field. This powder may be used repeatedly. It is available in several colors which aid in detecting defects on various colored surfaces.

Particles of various size are an advantage, as they bring out different characteristics of the flaws.

"Wet" testing

The method of magnetic testing under a liquid to hold the paramagnetic particles in suspension (popular in the aircraft industry) is covered by the expired patent illustrated. Other patents cover improvements and formulas for this method. Particles may be held in suspension by agitation. Commercial units have a motor driven unit to agitate the liquid. In some instances the liquid is sprayed, or flowed on and in other cases the part "dunked".

In "wet" magnetic testing it is necessary to have fine particles that will remain in suspension for some time. A powder of black oxide of iron (Fe_3O_4) five to ten microns, or less, in size is preferable. In the patented,

Under-surface flaws can be detected with an oscilloscope
—see page 95 of this issue.

commercially offered powder a small percentage of steric acid is mixed with the powder and oil and then these ingredients are ground to a paste in a paint mill. A few pounds of this paste will make 10 gallons of testing liquid. Various liquids have been used including kerosene, naphtha and benzol as well as mixtures of these.

Testing oxygen cylinders

The patented method employed to test cylinders used to hold compressed oxygen presents some interesting features. Longitudinal cracks are dangerous, and transverse cracks such as cause failure of axles and pins are not apt to occur. To locate possible longitudinal defects the tank is placed in a machine where it can be slowly revolved, and an alternating current of about 1,000 amperes and 4 volts is passed through the cylinder itself. No coil or magnet is used on the work. A transformer is needed to obtain the high amperage. The passage of this heavy current through the cylinder

sets up a magnetic field flowing parallel to its circumference. The cylinder is revolved about two revolutions a minute and a testing powder is applied to it by means of a roller revolved by frictional contact with the cylinder. Powder readily gathers about any crack or other defect, and the entire surface of a large cylinder may be tested in a few minutes. An alternating current is preferable because the necessary apparatus (transformer) is more economical than that required to produce a direct current of high amperage (motor generator set).

Hard zones in welds

Magnetic testing may be used to test the normalizing or annealing of welds. In welding alloy steel, or steel of high carbon content, a hard zone may be produced in the base metal near the weld. Such hard streaks make a characteristic indication. A wide band of particles might indicate an internal defect. A narrow line in-

dicates a crack at or near the surface. A circular formation might be a blow hole or inclusion.

The use of alternating current is an advantage in locating defects near the surface because of its "skin effect." It magnetizes the outer surface only. The flux from direct current penetrates deeper and is advantageous for internal defects. Fatigue cracks start at the surface. In testing parts of alloy steel or hard steel like tools and crank shafts, the residual magnetism may be sufficient for testing purposes and after giving the part a "shot" it may be removed from the coil of cable or magnet; and retain enough magnetism for testing purposes.

Soft iron will not retain any magnetism, but some steel makes a permanent magnet that may be objectional as it magnetizes tools such as calipers or micrometers that come in contact with it, causing them to pick up metallic particles. A magnetized part is also difficult to caliper with iron calipers.

Demagnetizing

Ever since the advent of magnetic chucks, demagnetizers have been common in the shop. One of the older machines for demagnetizing consisted essentially of a frame with a revolving magnet. The work is brought under the influence of this magnet and slowly withdrawn from its field. The diminutions and reversals of this field accomplish the desired result.

If the work is passed through a coil in which alternating current at line frequency (60 cycle) is flowing, this will demagnetize it although, because of the "skin effect" of alternating current, the core or interior of the part will remain magnetized. If alternating current is passed through the part itself, and the amount of current slowly reduced by means of variable resistance, this will demagnetize it. It is generally impractical to completely demagnetize the work.

It is a revelation to visit a shop where magnetic inspection is used. The operation is rapid, requiring less time than the old method of whitewashing the part. While the original magnetic testing patent has expired and certain shop-built equipment may be used if desired, numerous patents, which will not run out for many years, cover basic improvements, and offer well engineered apparatus designed for specific purposes.

Industrial Training--No Charge



Training Within Industry is now under the War Man-Power Commission and has in operation twenty-two district offices throughout the country. On the evening of June 9th the Detroit district office presented to industry one of a series of lectures to acquaint industry production executives with the highly valuable and essential training services offered by this division, Job Instructor Training. Outlining this service which has been made available to all war production contractors and sub-contractors were the heads of the local Detroit Office, shown above, (reading from left to right) O. F. Carpenter, Associate District Representative, E. W. Day, Floyd W. Eaton and Carl D. Wheaton, who are the Assistant District Representatives. Absent from this picture is M. M. Olander, District Representative. The training within industry service, it was explained, will set up a program to train people in war production plants, free of charge to plants and sub-contractors who take advantage of the service. Before the end of the year thousands of new people will have to be trained and this is the government's method of accomplishing this to aid industry in general with their conversion and production problems.

Welding Techniques

By A. E. RYLANDER
Mechanical Engineer

WHILE manual welding still is predominant, the trend is definitely toward machine or automatic welding. This is natural in view of the intensive mass production of the times. However, even manual welding approaches a semi-automatic status with the introduction of positioners, whether they are standard commercial or specially designed.

In this respect, welding is analogous to the development of automatic tools and machinery, which were refinements of their hand operated progenitors. The basic elements being similar, the automatic operation does not differ materially from the manual; simply that the machine, set up for duplication, replaces operators who are variously skilled and whose quality and quantity of output varies accordingly. In addition to human error, the manual welder is slowed further by the necessity of replenishing the short welding rods in common use.

The capacity and capability of welding machines are known, and, barring occasional service, it will usually perform as designed and as established by actual operation. All other things being equal, the machine will do the work of many welders and, on the whole, do it better. At least, the job will be uniformly good or uniformly indifferent; if the latter, the fault will not be so much with automatic welding as with the way the job is engineered or set up.

One should not infer, however, that the machine will entirely displace the skilled operator in general practice. Its function, as with all automatic tooling, is definitely limited to mass production. Even there, the manual welder is usually first on the ground. He gets the job going while a machine is being designed and, usually stands

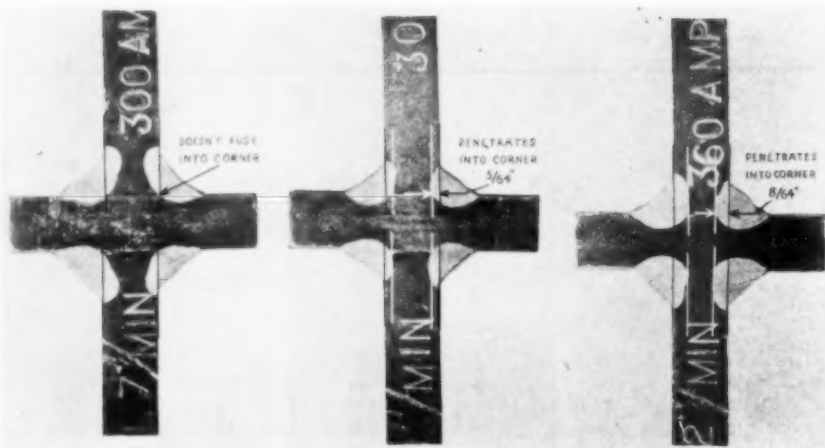
In the field of welding, Tool Engineers may be divided roughly into three groups: the specialists, who may be considered authorities and who overlap several fields; those with average, practical working knowledge of the art; and, in the third bracket, those who have everything to learn.

Everyone concerned with metal processing is interested in welding, and everyone has something to learn about it since new techniques are being developed continually. That the "experts" are avid for new ideas is understandable. Welding, though still in its adolescence, is one of the prime movers in the armament program, and is destined to play an important part in post-war reconstruction.

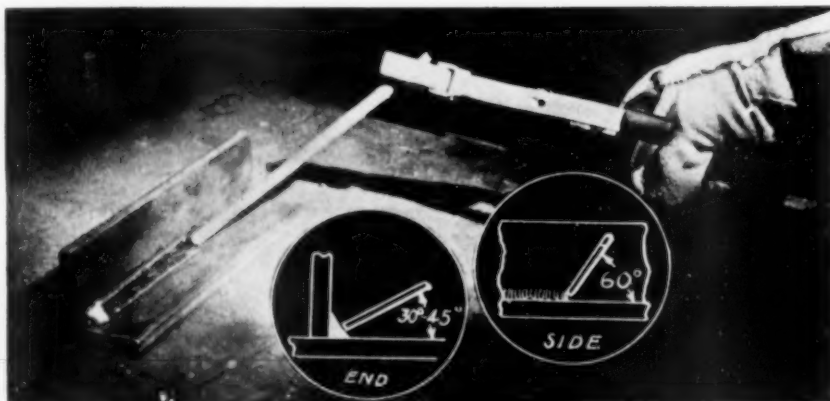
This article is a companion piece on welding procedures, following the discussion on Unionmelt in the May issue of *The Tool Engineer*. It is intended, however, to acquaint the interested lay reader with the various methods of arc welding now in vogue. Hence, the writing is generally descriptive rather than technical, serving as a prologue to future articles on the tooling and handling of welded assemblies. Constrained from specific applications, this article conveys ideas which the reader may apply to his own specific production problems. Salient features of various procedures are treated without prejudice for or against any maker of welding equipment. This article is an attempt to promote interest in an important phase of metal processing, and to inspire discussion of the subject even though experts may be critical of the approach.



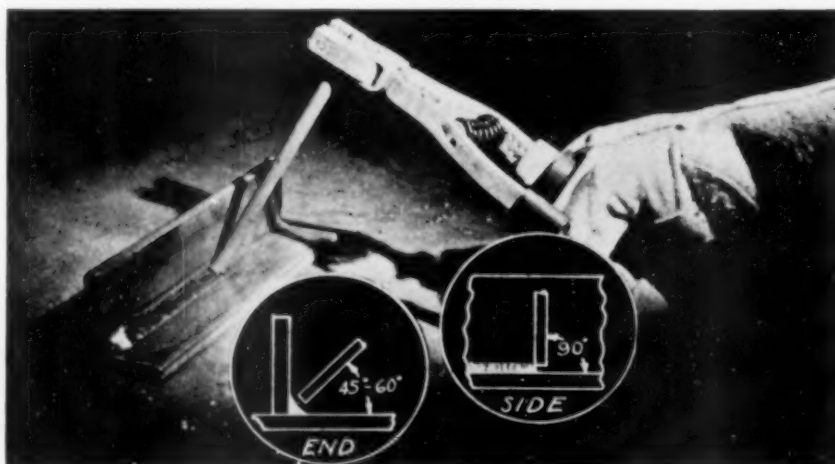
Though manual welding still is predominant, the trend is toward machine or automatic welding based on mass production principles. Even manual welding, however, approaches a semi-automatic status with the introduction of positioners.



Figures 2A, 2B, 2C. A development in manual arc welding is the "Fleet-Fillet" technique, which is featured by its makers as a speed-up in war production. A 100 per cent increase in production over conventional methods is claimed. Figure 2A, at left, shows weld by conventional method. 2B and 2C were made by "Fleet-Fillet" method.



Figures 3 and 4. Shown above and below are comparative positions of electrodes for conventional and "Fleet-Fillet" methods. The basic departure from convention, outside of the larger welding rods, is in the angular position of the electrode.



by while its creators iron out the bugs.

Like skilled craftsmen in all arts, there aren't enough qualified welders to meet present demands. Hence most Tool Engineers probably are biased in favor of things automatic. This

prejudice, nonetheless, is tempered by due respect for the skilled artisan and the tools of his trade. Yet, in an automatic age, and especially at a time when mass production must keep pace with war demands, it is a wise

Tool Engineer who develops the automatic device while he gets started with slower manual methods.

In the selection of arc welding equipment, the prospective user has a wide range of choice. This applies equally to automatic as well as manually operated equipment. Hobart Bros. Co. and The Lincoln Electric Company, of Troy and Cleveland, Ohio, respectively; General Electric Company, Schenectady New York, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania, and Una Welding, Inc., of Cleveland, Ohio, have each been prominent in the development of arc welding, as has Linde Air Products Company, mentioned in a May, 1942 TOOL ENGINEER article on Unionmelt. Of these concerns, some have specialized in automatic welding with remarkable results, while others have developed unique applications in manual arc welding as well as machine welding. One may profitably investigate the merits of all, with full confidence in the makers' recommendations.

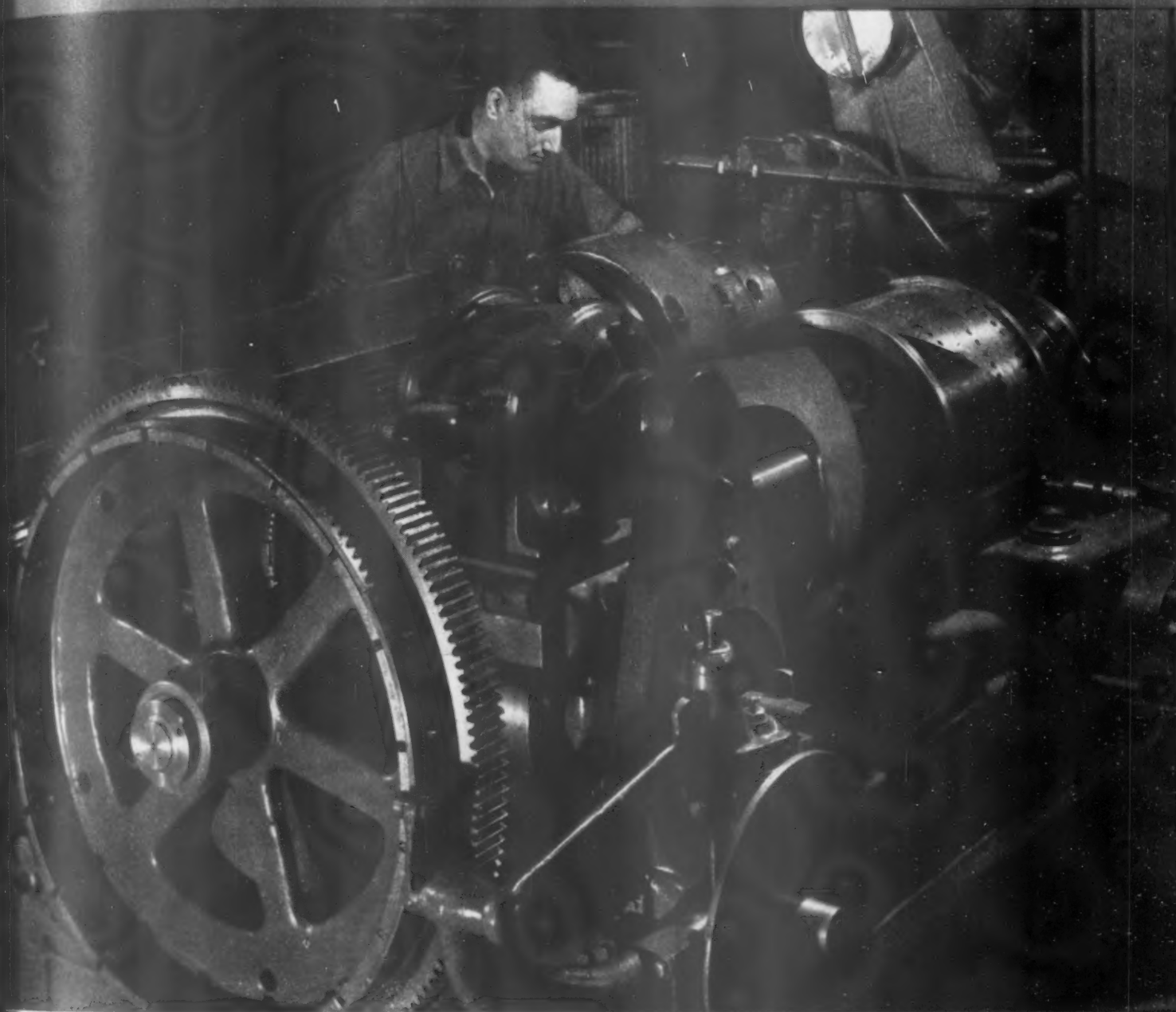
Fleet Fillet Technique

As a development in manual arc welding, Lincoln Electric introduced its "Fleet-Fillet" technique, which the makers feature as a speed-up in war production, claiming 100 percent increase in production over conventional methods. For example, an arc speed of 65 feet per hour is claimed for this new technique as against 30 feet, by conventional methods. Obviously, this method should greatly speed up the production of ships, tanks, gun carriage and other vital war equipment.

Comparative cost data is shown in Table A, prepared by Lincoln Electric. The chart is amplified by the illustrations, Figures 2A, 2B and 2C, while Figures 3 and 4 show comparative positions of electrodes for conventional and Fleet-Fillet methods. Without going into complete details, it would seem that the basic departure from conventional, outside of the larger welding rods permitted, is in the angular positioning of the electrode. Figure 5 shows a 16 pass fillet weld in 1 1/4-inches plate, built up by this method.

Producing as diversified equipment as perhaps any manufacturer of arc welding equipment, General Electric has developed the Atomic-Hydro-

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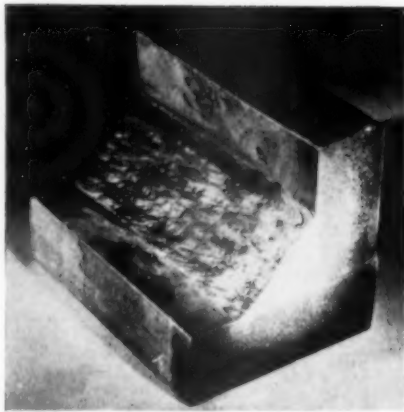


Figure 5. 16 pass weld in 1 1/4 inch plate made by Fleet-Fillet method.

gen Arc-Welding method. This method is especially suitable in tool and die work since metal of practically identical analysis can be applied to work to be built up or repaired. It is claimed that deposits can be varied from very thin surfacing to very heavy, with the job free of pin holes and spatter. Also, it can be used on most of the ferrous alloys. As its makers state "it is not quite so inexpensive as the ordinary arc welding processes", it is recommended mostly for those applications which cannot be successfully handled by ordinary methods. It can be had for manual as well as for machine welding, as demands of production warrant.

The A-H process varies from the ordinary in that the arc is maintained between two electrodes instead of between one electrode and the work. Also significant is the fact that the arc occurs entirely in an atmosphere of hydrogen. Because the arc is independent of the work, it can be moved at will, providing an unusually mobile tool valuable in welding fine and delicate work. A tungsten electrode holder is used in Atomic-Hydrogen arc welding. The hydrogen is fed from a pressure regulated tank.

The A-H method also can be successfully applied on production work, General Electric having developed an automatic head similar to its conventional heads except that it feeds two electrodes. The head may be moved by means of a travel carriage or the work may be moved, depending on the nature of the job.

General Electric also puts out two other automatic arc welding heads—Types WFB and WFH—used respectively for lightly coated or bare electrodes, and for heavily coated electrodes.

TABLE A

Comparison Tests for Single-Pass Horizontal Fillets, (not positioned), Made by Conventional and "Fleet-Fillet" Techniques

	Figure 2-A (Conventional Method)	Figure 2-B ("Fleet-Fillet" Method)	Figure 2-C ("Fleet-Fillet" Method)
Electrode	1/4"—"Fleetweld 9"	1/4"—"Fleetweld 9"	1/4"—"Fleetweld 9"
Current	300 Amp. D.C. Electrode Neg.	300 Amp. D.C. Electrode Neg.	360 Amp. D.C. Electrode Neg.
Arc Speed—Inches per Minute	7	10	12
Size of Fillet—as now defined	24/64"	17/64"	18/64"
Apparent Throat 0.707 x (Size of Fillet)	17/64"	12/64"	13/64"
True or Effective Throat	17/64"	17/64"	20/64"
Penetration beyond root or corner	0	5/64"	8/64"
Ultimate load of joint in pounds per inch of length	27,000	27,000	Plate failed at 30,000

Costs

Pounds of electrode per foot of weld	.37	.26	.26
Electrode cost per foot of weld*	2.2 cents	1.5 cents	1.5 cents
Labor cost per foot of weld†	5.8 cents	4.0 cents	3.3 cents
Overhead—100% of Labor Cost	5.8 cents	4.0 cents	3.3 cents
Total Cost—Labor, Electrode and Overhead	13.8 cents	9.5 cents	8.1 cents

*Electrode cost figured at 6 cents per pound.

†Labor cost figured at \$1.00 per hour with a 50% operating factor.

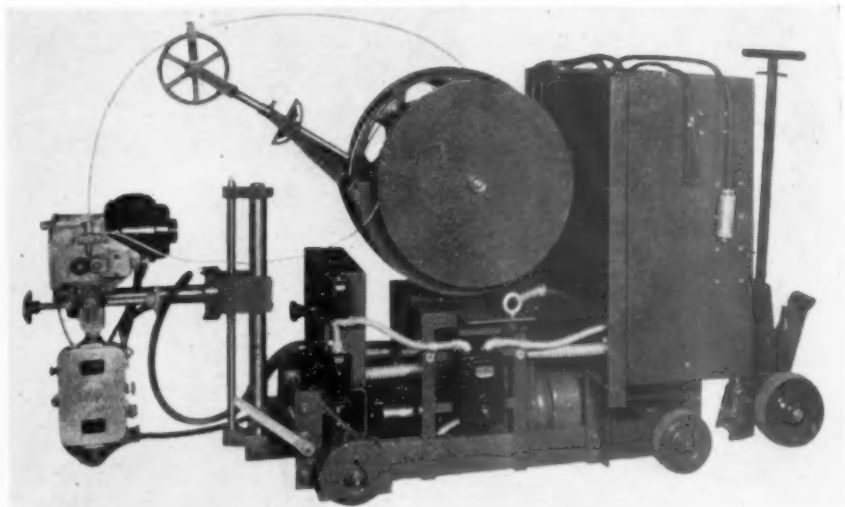


Figure 6. Unamatic Process of automatic arc welding affords interesting possibilities for the welding engineer. Makers of this automatic equipment claim three to four times the welding speed obtainable by manual operation. The automatic head shown in the above photograph is used in combination with a self contained tractor carriage. This unit is especially applicable to long seam welding. Special feature of Unamatic equipment is a method of applying a fluxed or impregnated tape to a steel wire to produce in the weld deposit a quality of deposited metal of almost any combination required for the job. Thus a considerable range of applicability is achieved on metals ranging from low carbon to stainless steel.

HOW TO DESIGN AND GRIND CHIP BREAKERS FOR CARBIDE STEEL-CUTTING TOOLS

Since Carboloy tools operate at speeds usually several times faster (generally in excess of 200 F.P.M.) than high speed steel tools, the problem of economical, safe, chip disposal is one that must be considered when employing carbides for cutting steel. Ordinarily, when machining steel, a continuous chip is produced. Easy chip disposal requires that this continuous chip be broken into

relatively short lengths that can be readily removed from the machine. The most widely used type of chip breaker for this purpose is the ground-in step-type breaker.

A general guide to the design and grinding of this type is shown below. Further details are contained in the 32 page Carboloy Tool Manual, available free upon request.

— DESIGN HINTS —

9 Styles of Standard-Stock Tools Available for Cutting Steel

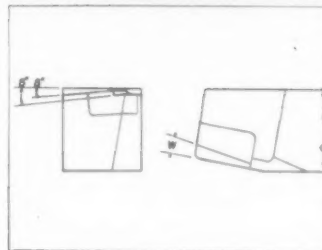
Carboloy Standard Tools—stocked for prompt delivery—include nine styles furnished in grades for cutting steel. Adaptable to 80% of all turning, boring, facing jobs, Carboloy standards can be quickly converted—in your tool grinding room—to special shapes required. One large mid-western plant, for example, uses just 9 Carboloy standard styles for 89% of all carbide tool applications in the plant. This standardization has resulted in lower tool inventory, reduced tool costs, and has enabled them to get carbide tools on the job fast. No delays awaiting deliveries of special shapes . . . they make their own specials by adapting standards.

Here is a typical example: Machining cast steel reduction gear blanks for the main drive of destroyers (see cut) .14 specially shaped tools required. Ordinarily that means several weeks of waiting. But this plant takes just four styles of Carboloy standards from their stock, grinds them to the 14 special shapes in an average time of less than 10 minutes per tool!

In this emergency period—when every minute counts—Carboloy Standard Tools, more than ever before, are of utmost importance to your plant. Send for catalog GT-140-R.

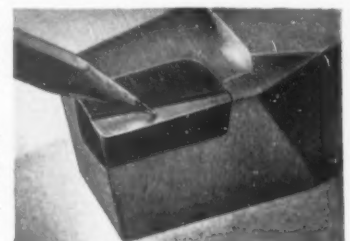


One user "makes" 14 special carbide tools for this job in less than 10 minutes per tool



At the high cutting speeds common with Carboloy tools, chips present a problem in safe, economical disposal.

The ground-in step-type is the most widely used type of chip breaker. Recommended for practically all kinds of steel cutting jobs.



RECOMMENDED WIDTH OF CHIP BREAKER (W)

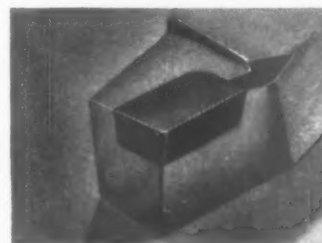
FEED In. Per Rev.	.008-.012	.013-.017	.018-.022	.023-.027	.028-.032
1/64 - 3/64	1/16	5/64	3/32	7/64	1/8
1/16 - 1/4	3/32	1/8	5/32	11/64	3/16
5/16 - 1/2	1/8	5/32	3/16	13/64	7/32
9/16 - 3/4	5/32	3/16	7/32	15/64	1/4

NOTE: A chip breaker depth of .020 is satisfactory for most types of steel.

In step-type chip breakers, it is desirable to have same rake angle on both the top surface of tip, and chip breaker.

Usually adjustments only in width of breaker are necessary. This table is general guide to correct widths for various feeds and depths of cut.

— GRINDING HINTS —



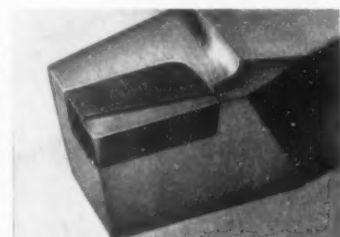
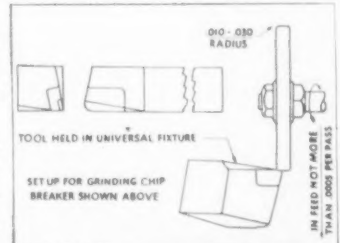
Make sure that all tool angles have been rough and semi-finish ground to desired shape, and steel shank relieved behind tip.

Then set up tool in universal vise on a cutter, surface or chip breaker grinder. Use a 100 grit resinoid bond diamond wheel.



Use kerosene or soluble oil, applied with wick, to keep diamond wheel open. Grind full width of breaker. Use down feed not exceeding .0005 per pass.

Finish grind tool shape after breaker is completed. This removes any minute nicks developed during breaker grinding.



Send for free 32-page Carboloy Tool Manual

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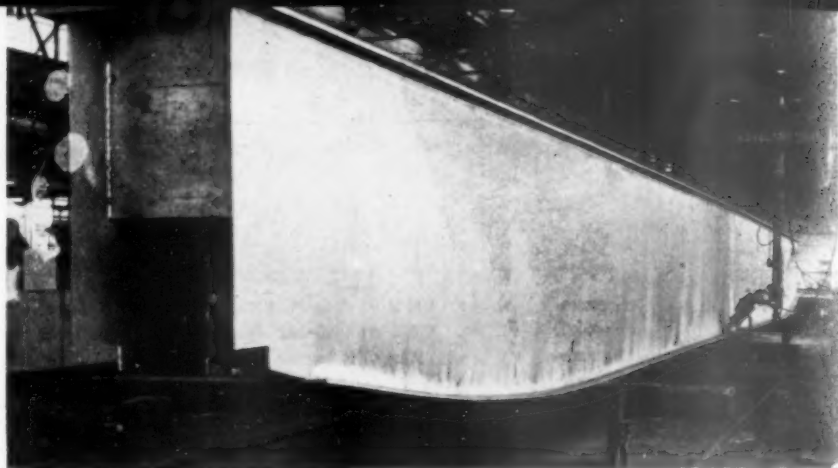


Figure 7. The Unamatic Process is especially applicable to long seam welding. Shown here is an installation with a gantry crane for fillet welding a long girder box. Two heads are operated simultaneously. Work hides one head.

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single reduction worm gear driven by a high torque, direct current motor, the speed and rotation of which is automatically regulated by the thyatron control. Positive drive for both electrode feeders is thus obtained directly through a short, heavy shaft carried on ball and roller taper bearings". This broadly describes the operation of both the WFB and WFH heads, since both operate on the same principle.

Unique in concept and design, the Unamatic Process of automatic arc welding, a product of Una Welding, Inc., Cleveland, Ohio, affords interesting possibilities for the welding engineer. It is the favorite of at least one prominent Tool Engineer, general master mechanic of a large automotive plant, who has used it in the fabrication of rear axle housings. This design incorporates a unique differential, consisting of one D. C. and one A. C. motor which, alternately advancing and retarding the electrode, maintain a uniform arc gap at all times. In this connection, all automatic heads must provide for positive gap control, otherwise they could not function. Each maker naturally claims advantages for his own method. A logical observation is that any welding device marketed by a reputable manufacturer is good or it couldn't compete in a field where only the best survive.

Entirely Automatic

Unamatic, as its name implies, is entirely automatic. Its makers claim, among other things: three to four times the welding speed afforded by manual operation; uniform arc conditions; lower manufacturing costs and elimination of highly skilled operators. All of these claims are justifiable. Unamatic incorporates a

How

TO ORDER GAGES

When an order for fixed size gages fails to include complete gage specifications, the missing information must be gotten by further correspondence before the order can be put in production. This delays procurement of these vital tools and it also puts an extra burden on the time of procurement personnel. Both can be prevented by including all the following information on gage orders.

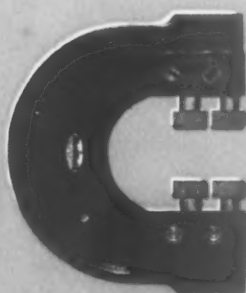
PLAIN PLUGS and RINGS



- 1 Size (Go and Not Go).
- 2 Class of gage makers' tolerance.
- 3 Members desired—Go, Not Go, Handle.
- 4 Length of member—standard or extra long.
- 5 If progressive member is wanted, so state.
- 6 Complete marking instructions.



SNAP GAGES

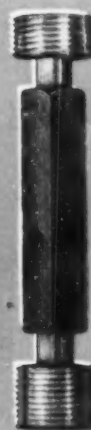


- 1 Frame size.
- 2 Frame model.
- 3 Range.
- 4 Stipulate whether gage is to be set and sealed.
- 5 Complete marking instructions.

THREAD GAGES



- 1 Size (Go and Not Go).
- 2 Threads per inch.
- 3 Class of fit for the work part.
- 4 Class of gage makers' tolerance or pitch diameter.
- 5 Members wanted—Go, Not Go, Handle.
- 6 Complete marking information.
- 7 Whether or not a setting plug is to accompany a ring gage.
- 8 If setting plug is ordered, whether ring gage is to be set and sealed.



It is always strongly recommended and good practice to order a setting plug for every thread ring gage purchased because there is no other good way of accurately checking ring gage wear or of resetting the ring gage to compensate for that wear.

The gage maker does not set and seal a thread ring gage unless he also furnishes a setting plug. He cannot do this because of the three variables involved, pitch diameter, lead, and thread angle. Every one of these is interrelated and every one may vary within its own tolerance zone. Thus, a thread plug and a thread ring made at different times or by different manufacturers may both be well within their tolerance limits in every element and still, because of these small cumulative differences, the two might not fit together precisely. When both the ring and the setting plug are made together, these differences can be adjusted, but not otherwise.



THE SHEFFIELD

CORPORATION

DAYTON, OHIO, U. S. A.

method of applying a fluxed or impregnated tape to a steel wire to "produce in the weld deposit a quality of deposited metal of almost any combination required for the job". For example, it is being successfully applied to various metals ranging from low carbon to stainless steel which may meet the ordinary requirements for shielded or protected arc deposited metal. The makers further claim to be able to deposit hard surfacing metals ranging from 300 to 650, Brinell hardness, all in addition to advan-

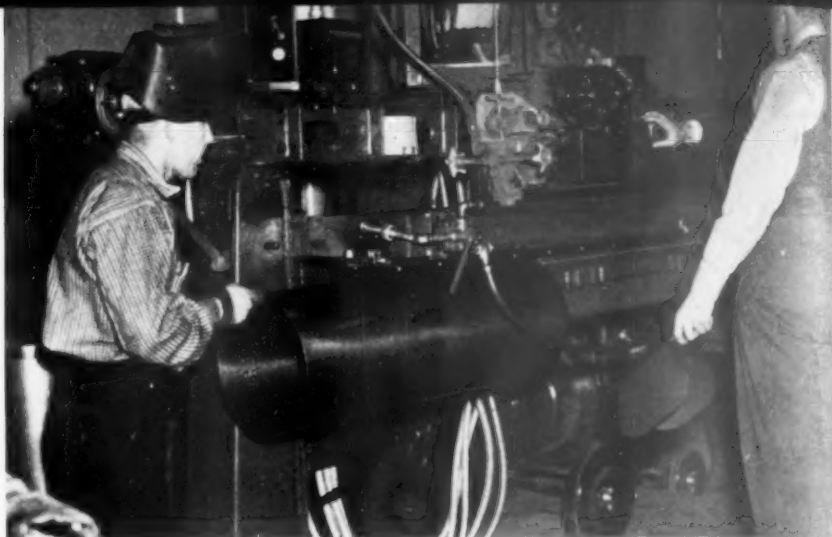


Figure 8. Automatic welding head in combination with a horn type welding fixture for application on longitudinal welds, as for cylinders and hollow rolls.

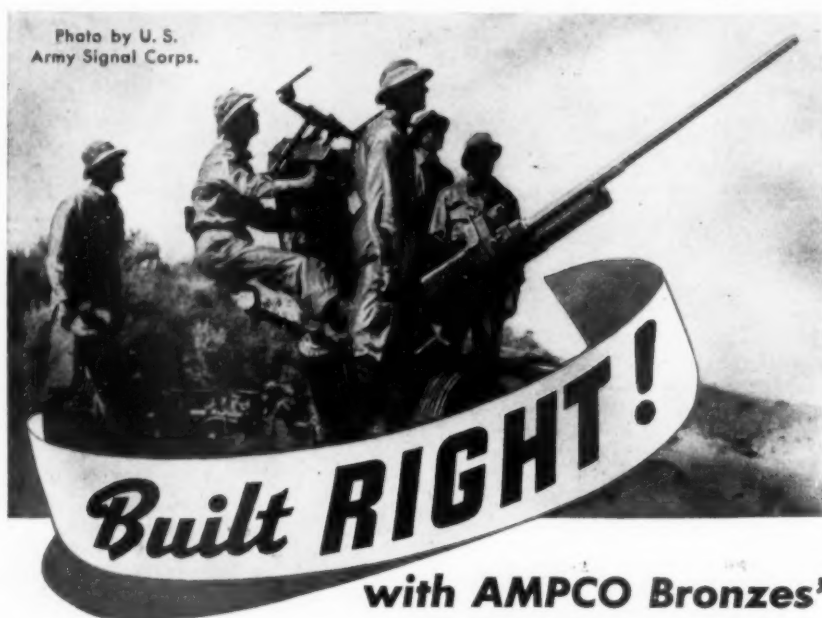


Photo by U. S.
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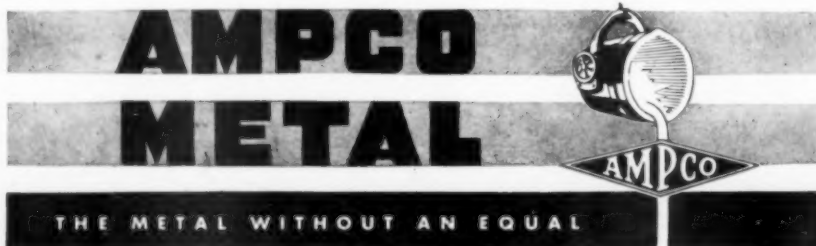
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tages of automatic welding.

An excellent view of the automatic head is shown in Figure 6, in which it is shown in combination with a self contained tractor carriage. This unit is especially applicable to long seam welding. Figure 7 shows an installation with a gantry crane for fillet welding a long box girder, two heads operating simultaneously. Obviously, one head is concealed behind the work. Figure 8 shows the head in combination with a horn type welding fixture for application on longitudinal welds, as for cylinders, hollow rolls etc. Figure 9 shows an advanced type of high production welding fixture for uniform rotation of work with head stationary. This set-up suggests numerous possibilities.

Head or Work Movable

To a considerable extent, and with only slight variations, all automatic welding heads operate on a common principle; i.e., the head travels on a track, with the work stationary, or, the head may be fixed and the work movable. For that matter, the head may be made to rotate the full 360 degrees on awkward assemblies which in themselves preclude practical rotation. The preferable way, however, is to rotate the work in a positioner, but in this case the welding is manual while the positioner itself rotates, being universally power driven. Now, if production warrants, it would be as easy to use the positioner in combination with an automatic head, which then would be fixed. Provision would have to be made, however, to "recede"



THE OSTER NO. 601 "RAPIDUCTION" LATHE Speeds Production of 20mm, 37mm, 40mm Shells

Shell manufacturers were quick to recognize the advantages of the Oster No. 601 "RAPIDUCTION" Lathe.

SIMPLIFIED design; quick adaptability to a wide range of tooling set-ups and operations; availability with optional six position turret or plain saddle and tool holder; optional worm drive or direct drive; and many other features of optional or extra equipment make the Oster No. 601 ideal for manufacturers of 20mm, 37mm, and 40mm shells.

Quicker training of new operators is a big advantage of the No. 601 "RAPIDUCTION" Lathe. Manual operation of the six position turret eliminates the highly skilled set-up work required on the more complicated automatics.

Price? The No. 601 "RAPIDUCTION" (without tools) costs less than \$2000 which includes the complete machine with either DIRECT or WORM drive; coolant pump; sheaves and belts; automatic push-out collet chuck; chuck with master collet but less all pads; with ratchet type bar feed; lever feed cross slide; six station manually indexed turret; two speed 1800/3600 R. P. M. 3/4 H. P. constant torque, 220, 440, or 500 Volt, 3 phase, 60 cycle motor, manual speed control and electric brake.

* * * * *

Complete details including tooling set-ups, operations, and production estimates on 20mm, 37mm, and 40mm projectiles will be furnished promptly to qualified manufacturers.



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Rush, by return mail copies of Catalog No. 27-A which contains full description and detailed illustrations of No. 601 Turret Lathe.

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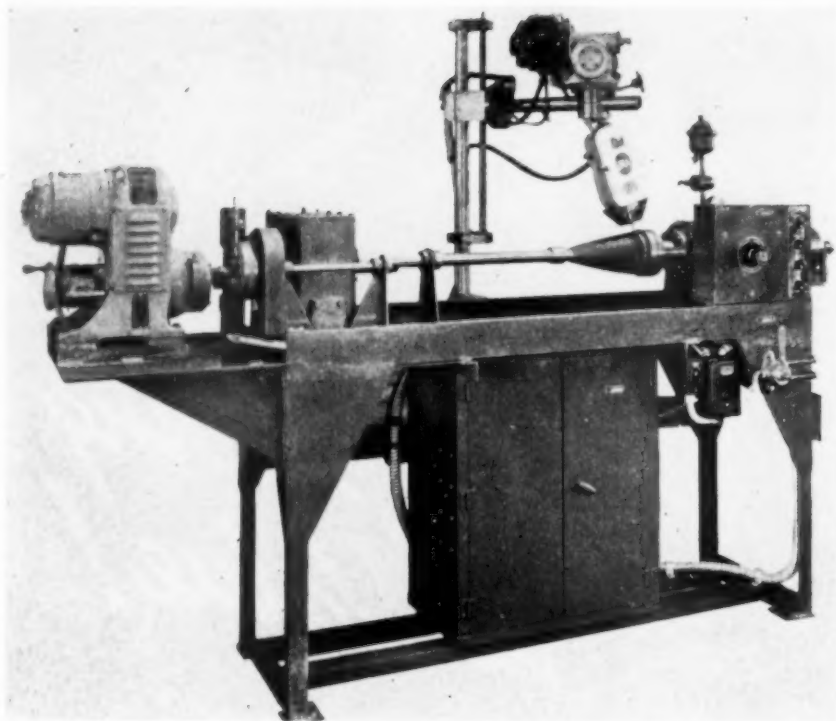


Figure 9. An advanced type of high production welding fixture for uniform rotation work with head stationary.


it when loading and unloading the work.


Thus it has been established that automatic arc welding heads, by themselves, cannot advantageously

be used except in combination with designed fixtures, positioners and/or tracks on which they may move in straight or curved lines.

The automatic head is largely a self contained accessory or unit, like the self contained drilling unit which, provided with spindle drive and automatic feeds, must nevertheless be used in combination with a machine bed and the necessary work holding fixtures. The machine (or fixture) naturally will be designed to suit a specific job; and as such, it becomes a single purpose tool much like any automatic machine. There is, however, the advantage that the welding head, with its transformer and controls, is always salvable, to be used on other jobs. That should also hold true, to a considerable extent, for the fixtures if flexibly designed. The Tool Engineer who knows his business will anticipate changes in product and design accordingly.

This is the second of a series on welding techniques. Fixtures, and positioners, especially in combination with automatic welding heads, will be discussed in an early issue of *The Tool Engineer*.





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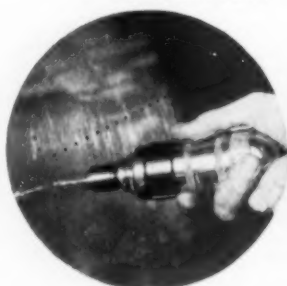
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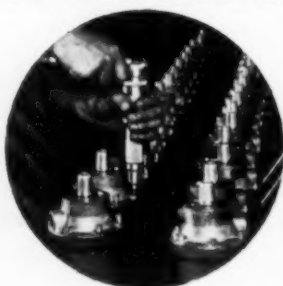
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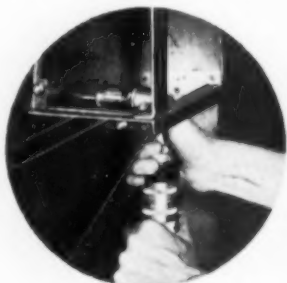
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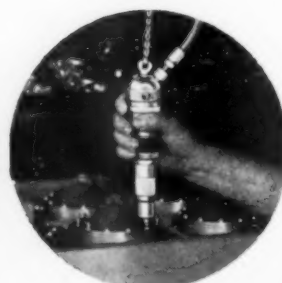
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Method of Making A Spring Clip

L. Kasper

**How to overcome effects of
spring-back, by producing
parts of uniform accuracy**

THE clip shown in Figure 1 is made of hard rolled wire, the requirements being that the diameter X be held to close limits, and that the ends lay together with a definite amount of tension. The greatest difficulty lay in overcoming the effects of spring-back, so that the ends would snap together. The following method,

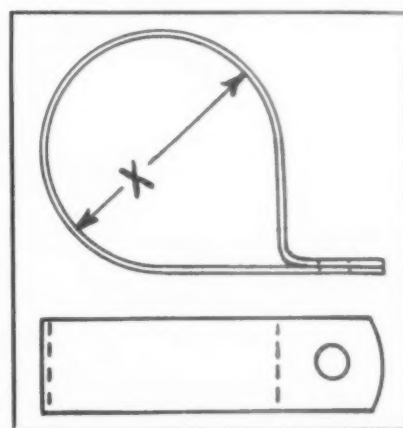


Figure 1

which was developed after some experimenting, produces a uniform product with the required accuracy.

Uses Hand Fixtures

After the blanks are cut and pierced, one end is located on the pin E, which is carried in a fixed block on a hand fixture, as in Figure 2. A loop is then formed by the roller B rolling the material around the pin A. The spring-back of the material produces the shape shown in Figure 2. The diameter of the pin A, which must be determined by experiment, is such that the inside diameter of the clip as formed by this operation will be slightly less than the diameter X , in Figure 1.

The final operation is performed in

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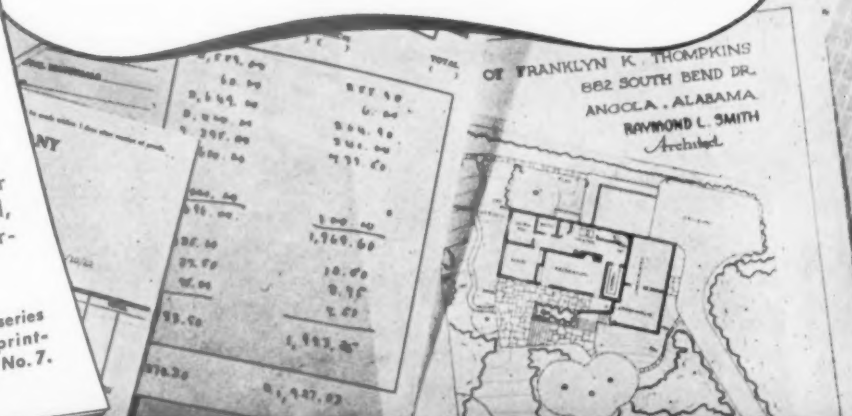
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This is the sixth of a series of facts on modern printmaking. Watch for Fact No. 7.



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a power press, as shown in Figure 3. The block C, which is fixed in position, is formed to the exact shape and dimensions as the inside of the clip shown in Figure 1. As the clip at this point is slightly smaller on the inside than the block C, it must be sprung open slightly to be located on block C, thus providing the tension which is one of the requirements.

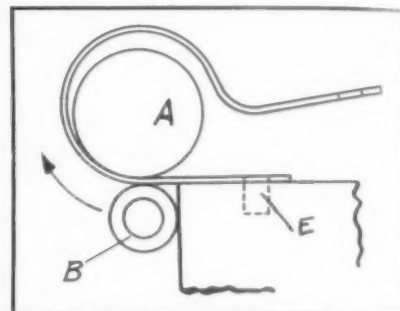


Figure 2

The pin F, which locates the work, is carried in a movable block, which is raised to clamp the lower leg of the clip against the lower edge of block

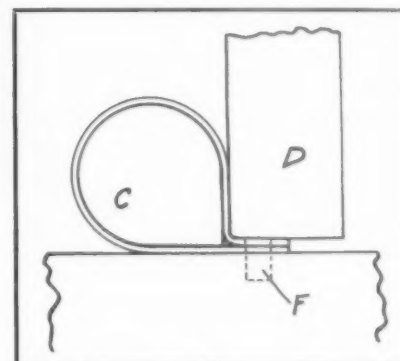


Figure 3

C. Pin F extends out of the block slightly less than the thickness of the material. As the punch D descends, the clip is formed as in Figure 3. As this operation may be classed as an ironing rather than a bending operation, there is practically no spring-back of the material. When the clip is removed from block C, it retains its shape and the tension it acquired by being sprung on block C.

"Making Circular Parts of True Diameter in Power Presses." See THE TOOL ENGINEER, June 1942.

THE TOOL ENGINEER

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When writing your orders, take an extra minute to add some helpful data. Tell your tool manufacturer all you can about the job—explain the cutting conditions, state the tolerances and, whenever possible, enclose a print of the part showing the surfaces to be machined. This information will help your tool maker do his job better and will help you get tools that do more and last longer!

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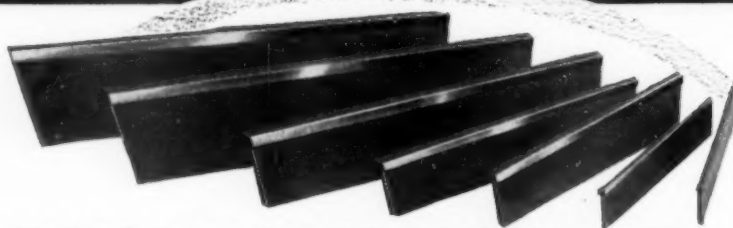


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TOOL WORKS

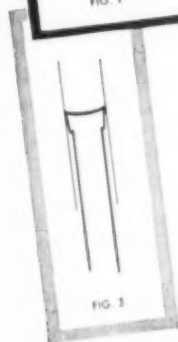
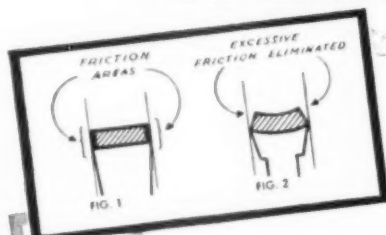
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You can see by referring to Fig. 1 that a chip produced by a blade of the conventional type will be flat. The cutting action of the blade causes this flat chip to expand and jam against the walls of the cut, creating excessive chip friction which results in rapid breakdowns of the blade.

A chip issuing from the Luers Blade (Fig. 2) assumes a curved shape conforming with the hollow-ground top of the blade. In this curved form the chip is free to collapse into the concave top of the blade and cause the least amount of contact with the restricting sidewalls. Excessive friction is eliminated.

But this is not the only factor that tends to eliminate excessive friction. The liberal side clearance

provided by the distinctive T-shaped design of the blade (Fig. 3), too, serves to reduce friction. Since this side clearance and the hollow-ground top both extend the full length of the blade, it is apparent that neither of these surfaces require regrounding. They both remain unchanged. That means that the task of sharpening is very simple—so simple, in fact, that even an unskilled operator can do it. Only the front face, or cutting edge, is ever sharpened. A special gauge permits even an unskilled operator to restore the blade exactly to its former position.

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Larson's Luck Holds

(Continued from page 102)

you got new machinery'. I told 'em. 'But hold your horses. If I don't start delivering, full quota, inside of two weeks, you can pull the job. But now listen. If I do deliver, you'll have to sign an iron clad contract at fifteen bucks. How about it?' They said they'd see, and went away.

"TO make a long story short—only I wanted to give you a line on the business angle—I did the job like this". He sketched on a paper napkin as he talked. "I couldn't swing the job on the machine, and it was so awkward it would have been a tough job balancing it even if it would have cleared the interferences. So you know what I did? Well, I made two fixtures, and bolted 'em to a special platen I had put on the cross slide. You know, like making a boring mill out of a lathe, the way they do sometimes in jobbing shops. Then I made the boring bars turn in special ball bearing holders, mounted on the turret and splined to drive from the spindle.

"I had to rough and finish bore, face both ends, chamfer one end and cut an annular groove close to the other end. I make a special slide tool, mounted on the spindle nose and fed with a star wheel; that took care of facing one end. The other end was faced with a tool something like it, and driven from a splined shaft. No balancing to worry about and we speeded her up so that, by golly, you'd think we was running a Russian steam bath instead of a machine shop. Besides we'd load one fixture while the other one was working, and that saved time.

"WELL, you know what they used to say in the old country: — 'For the mechanic nothing is impossible', and I guess that goes for tool envy—engineers too. Oh yes, the big fellows copied my idea—you see, we moved the turret back into the shop as soon as we got it going—and I helped 'em with improvements. We got to cooperate, you know, if we're to win the war, besides which they had to step up production and, like I said, I got an iron clad contract to deliver so many. Oh yes, the kid got his raise and I'll make a fair profit on the job, but not so much. Anyhow, the game's the thing."

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PRODUCTION PERSPECTIVES...

News, Review of Mass Manufacturing



Trends

"For a real worker, give me a man in shirt sleeves," one of the pioneers of mass production in America has said.

Proof that Tool Engineers have had their coats off since Pearl Harbor is the fact that fulfillment of the 1942 war production goal is now generally visualized. The boys will be glad to know that a recent War Production Board order lifted a previously imposed death sentence on coat hangers. Now, engineers can hang up their coats instead of throwing them on the floor before tackling another day's work.

The country's tool-makers have had their coats off too. Production figures since Pearl Harbor show that the manufacture and shipment of machine tools, presses and other machinery designed, built and used by Tool Engineers have hit new highs. In April, the fourth month after the nation went to war, the value of such equipment shipped mounted to \$114,100,000—a 72% increase over the same month last year. The trend toward a total yearly volume of more than \$1,300,000,000 was continued in April when manufacturers of comparable machines reported an over-all increase of eight percent over the preceding month.

With the machine tool problem well on the way toward being licked, a new bottleneck has become apparent. WPB experts claim to have known it was inevitable. It's small tools. An airplane engine manufacturer figures around \$1,500 cost in perishable tools per completed motor. Cost is important,

but more pertinent is the indication of replacement requirements.

One thing about these bottlenecks. They started way back in the picture. They are now appearing closer and closer toward the end of the assembly line. First bottleneck was convincing America that it needed arms. Next came Congress; then production authority. Machine tool production; now small tool production are operation headaches. The bottleneck we all look forward to is jamming the whole shooting match into Berlin and Tokyo.

The Biggest Job

The Army and Navy are fighting this war; but it will be won on the industrial front. Already, smoke from thousands of American factory chimneys is getting in Hitler's eyes.

Production is the key to victory. In the six months since that fateful December seventh, this country has moved from a defensive to an offensive position. Actual production of armaments is the sole reason.

Late last year, the United States was impressed with its war program of \$66,000,000,000. That program has grown to \$200,000,000,000, and still is on the upswing. Germany's war production program has been set at \$100,000,000,000.

When war was declared, U. S. factories were turning out \$2,000,000,000 worth of arms a month. Today, that figure has been doubled. By year's end, it is expected that war produc-

"GREENIE"—

She'll learn - -



tion will total \$5,000,000,000 monthly.

Estimating volumes of goods, on the basis of cost, obviously is difficult. Engineers, however, can interpret employment figures. Six months ago, 7,500,000 workers were employed in our war plants. Today, 10,000,000 men are employed at the job. In December, 15,000,000 men and women will be at work on supplies for the Allied forces.

Expansion

Successful production is contingent on raw materials. War industries are

now eating deep into the nation's reserve supplies to feed their machines.

The need for steel, plus the decision to reach top production now with existing facilities, has moved the War Production Board to stop plant expansion until steel mills now operating at 99 percent capacity are able to fill all orders.

Outstanding exception to this new rule is the commencement of work on two "mid-western" war plants so huge they compare in size with Ford's fantastic Bomber Plant at Willow Run,

Michigan. In line with conservation of steel, one of these plants, to be built by Chrysler Corp., will be a one story reinforced concrete structure with wood window sashes, wood picket fences, and arch-rib construction overhead. Altogether, it will save sufficient steel to build 14 destroyers, or a half dozen Liberty cargo ships.

Conservation

The order permitting the manufacture of coat hangers mentioned earlier suggests an inquiry into the reason for the original "stop work" order on more than 400 civilian products.

Conservation of vital and critical metals badly needed in war production was the justification. On this basis, the discontinuance of fountain pen manufacture must appear inexplicable to an engineer at work on heavy ordnance.

The efforts of Tool Engineers to speed war materiel manufacture are nullified the moment supplies of iron and steel stock cannot be delivered to production lines. To guard against such an eventuality is the reason for discontinuing the manufacture, after a "tapering-off" period, of articles as workaday as office machinery and as frivolous as cocktail shakers.

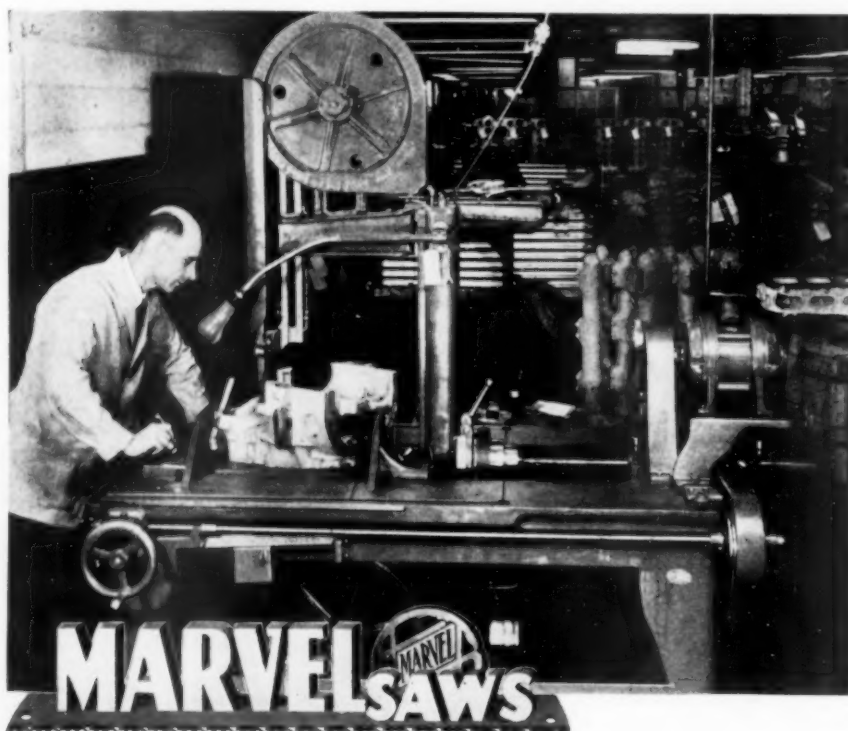
The answer is found in facts and figures. More than 2,800 tons of steel were consumed last year in manufacturing fountain pens and automatic pencils. That metal may this year be converted into 430,000 three-inch shells.

The 16,000,000 pounds of steel used in making women's hair pins last year can be turned into 160,000 more .50 caliber machine guns.

The specific savings in metal from eliminating the manufacture of manicure instruments should be sufficient to make the most fastidious willing to bite their nails for the duration. Actually, the 1,815 tons of hard steel thus saved for war production could be converted into some 170 guns of 155 mm; more than 61 of the medium tanks the British have called "the cat's whiskers;" or a total of 44,300 big .50 caliber machine guns.

Lumped together, the production of military equipment made possible by the diversion of metals from these three civilian items is sufficient to affect the balance of power in a crucial battle.

Admittedly, the industrial dislocation resulting from curtailment of civilian goods is severe in many lines. The WPB order banning the installation of air conditioning and commercial refrigeration equipment except to meet war and essential civilian requirements shook 700 manufacturers to their very roots. Their factory sales of machinery had



Photograph courtesy Packard Motor Car Co.

A MARVEL No. 8 Speeds All-out Production of Packard Rolls-Royce Aircraft Engines

MARVEL Sawing Machines are playing an important part in speeding production for National Defense. Not only the MARVEL 6A and 9A High-Speed Production Saws that automatically cut-off rifle barrels, gears and parts from bar stock in great quantities; or the giant MARVEL No. 18 Hydraulic Saw so well known for its cutting Speed; but all other MARVEL Saws, too, each in its own way, are at work in America's "all-out production." Take for example, the MARVEL No. 8 Universal Band Saw illustrated above, working on aircraft engine crank-cases in the "D" Division of the new Packard Rolls-Royce Engine Plant.

Because of its large capacity (will handle work up to 18" x 18") because it cuts at any angle from 45° right to 45° left; and because the blade remains vertical throughout its straight-forward carriage travel, the MARVEL No. 8 will do trimming, notching, mitering and cutting-off, and will save hours of machining by roughing out work to size and shape.

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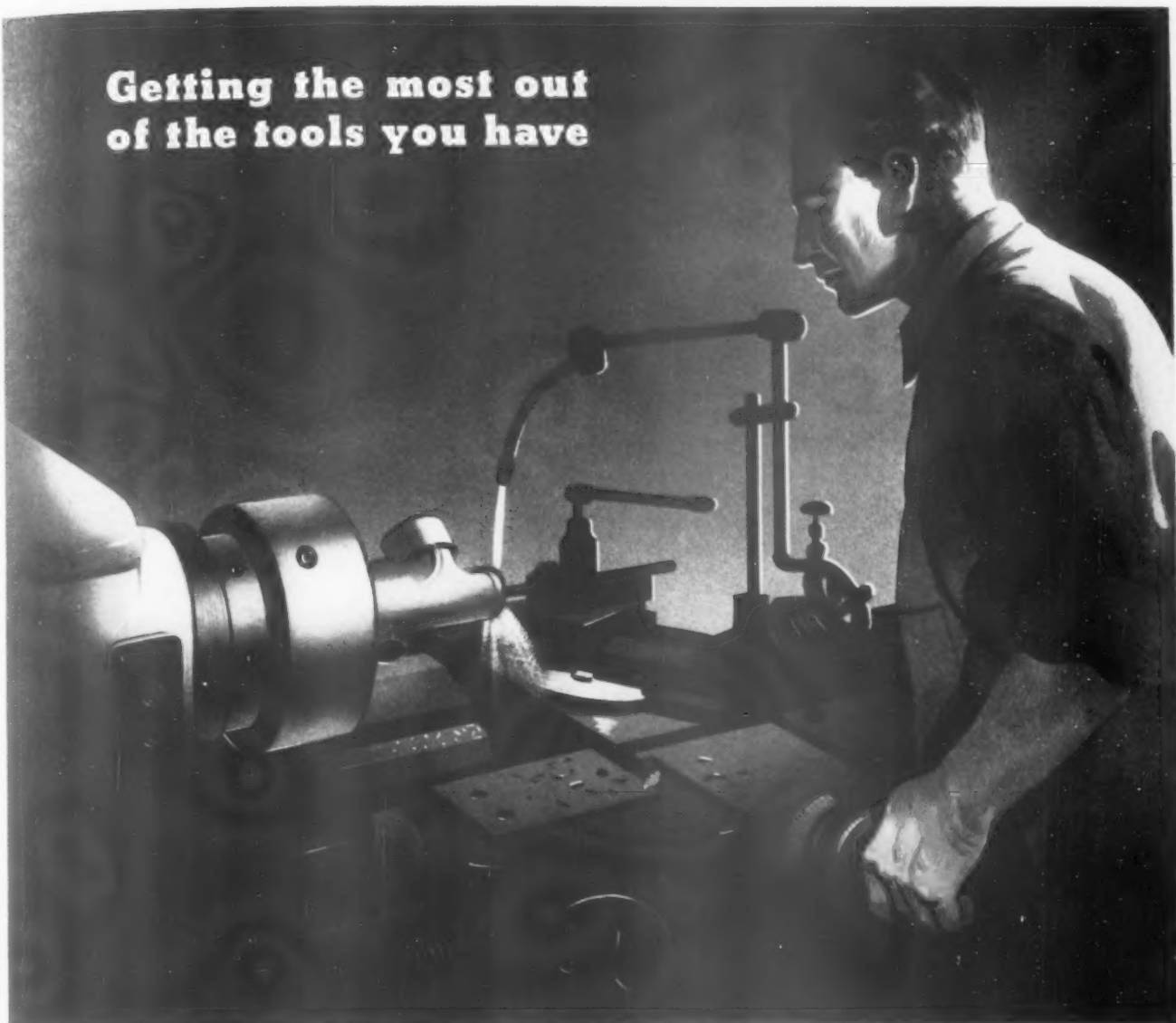
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**Getting the most out
of the tools you have**



Information supplied by "Tool Engineer"

Everyone knows today that the job of the Tool Engineer is how to figure to get the most out of critical tools and equipment. Production must be scheduled so that bottlenecked machines are 100% busy on bottleneck jobs that less critical equipment cannot do. On the other hand, machines which are much easier to get must be tooled up for doing all the work that they can so as to relieve pressure on the hard-to-get machines.

Everyone knows that multiple special automatics, vertical turret lathes and regular turret lathes work faster than engine lathes. There are probably more engine lathes in existence than almost any other type

of machine tool. Therefore, Tool Engineers have recognized or rather, should recognize that an engine lathe with a good man to operate it can produce just as much as a turret lathe and that the costs will be comparable.

For example, a threading job on a turret lathe uses an expanding die head only fifteen or twenty percent of the time while on an engine lathe it can be used up to 80% of the time. Thus another station is opened on a turret lathe — pressure is relieved on a critical tool. At the same time, the expanding die head, a critical tool, is working nearly 100% of capacity.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

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totalled approximately \$17,500,000 in the last quarter of 1941.

The Babies Win

"Well!" was the indignant exclamation of the girl at the Tool Engineer's mail desk the other day as she read a WPB news release covering priorities on baby carriages. This, it appeared, is a subject that strikes closer to the heart of American women than the ban on hair pins.

"War or no war," she explained, "nothing is as certain as babies!"

Recognizing this fact, the government agency has devoted considerable study to the subject of perambulators. An obvious effort to defy the strange ways of nature ended in the continued production of carriages redesigned to contain none of the more critical metals and a minimum of iron or steel.

The production czars have thoughtfully divided carriages into three groups; Group 1 ("for a young baby"); Group 2 ("meaning a stroller intended for an older baby, usually a baby able to sit up"); and Group 3 carriages ("meaning a baby walker").

In any instance carriages for Junior (around late 1942) may not utilize more than six pounds of iron or steel, including hardware.

Annual sales of the 25 manufacturers in the field amount to approximately \$8,250,000. All things considered, the chances are that most of them will stay in business, using wood instead of metal.

Revelation

Recognition of machinery as essentially a raw material in the war production drive has resulted from efforts at price fixing by the Office of Price Administration.

Establishing base prices on machine tools has been one nut a little too hard for cigar smoking Leon Henderson to crack. The gentleman who recently rode his secretary (very attractive) on the handlebars of a bicycle down Pennsylvania Avenue for publicity pictures has pointed out that 77 percent of the machine tool industry's output is sold directly by manufacturers to users. Less than three percent reaches users through retail outlets. The remaining 20 percent is marketed through distributors or jobbers, who act essentially as commission agents.

Many of these products are specially engineered the boss price fixer has discovered! "Shelf Goods" are comparatively rare, and price lists and catalogs cover only part of the products. "Furthermore" the office of Price Administration says, "many of these products are basic, entering into the production of essential military and civilian needs at a very early stage. In this respect, machinery is comparable to a raw material."

Morale

Time proven is the old axiom that a nation at war is as strong as its morale. Building morale in a democracy is the job of the press.

Obviously news from battlefronts must be held in abeyance until such time as its release will not be deemed helpful to the enemy. Such censorship, logically, should be exercised by qualified military and naval strategists.

Thus remains the task of building morale on the home front, building morale among the men behind the men behind the guns. And here, production news is invaluable and records show that displaying completed war material to workers producing small parts for such equipment has resulted in a 25 percent increase in plant output!

Much of the story of the greatest conversion of machinery and manpower since the industrial revolution remains to be told. But we know the story in our

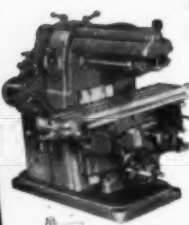
Atlas

CATALOG OF WAR EQUIPMENT

FOR SMALL PARTS PRODUCTION


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ATLAS PRESS CO.
KALAMAZOO MICHIGAN



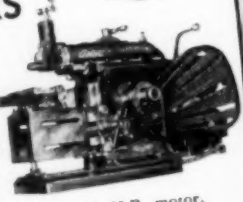
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Compact, powerful bench millers have backgeared power. Available with hand-operated controls, rapid production levers, or "Change-O-Matic" for instant selection of automatic feeds.



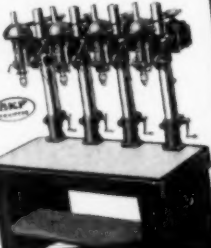
LATHES

Atlas F-series 10" backgeared, screw-cutting lathes fill every need as the basic, multi-purpose tool. Available with turret attachments.



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Handle all work within a 7" stroke accurately, economically, quickly. Timken-equipped crank-type built-gear drive, 5 automatic cross feeds, V-belt drive. Operates on 1/2 H.P. motor.



Multiple Spindle DRILLING MACHINES

Step up production, cut costs on small-hole drilling, tapping. Massive production oil table, solid floor legs, 4-, 3-, and 2-spindle models.

Quality Shop Equipment Since 1911

APEX POINTS

the way to increase production

It's just a matter of simple arithmetic. Consider the number of screws driven per hour by each Bit. Multiply that by the number of drivers. Then figure the loss in production every time a bit breaks, or wears out too soon, and the time out to make replacements.

APEX Power Bits and Hand Drivers have established phenomenal production records for long life and continuous service. Reasons: finest tool steel obtainable for the purpose; precisely engineered for each power driver; precision machined; properly and carefully heat-treated for toughness and long life.

In addition, APEX-Phillips Power Bits can be reconditioned time after time at a substantial saving. Each reconditioning shortens the Bit only $\frac{1}{8}$ ", and it is just as serviceable as a new one.

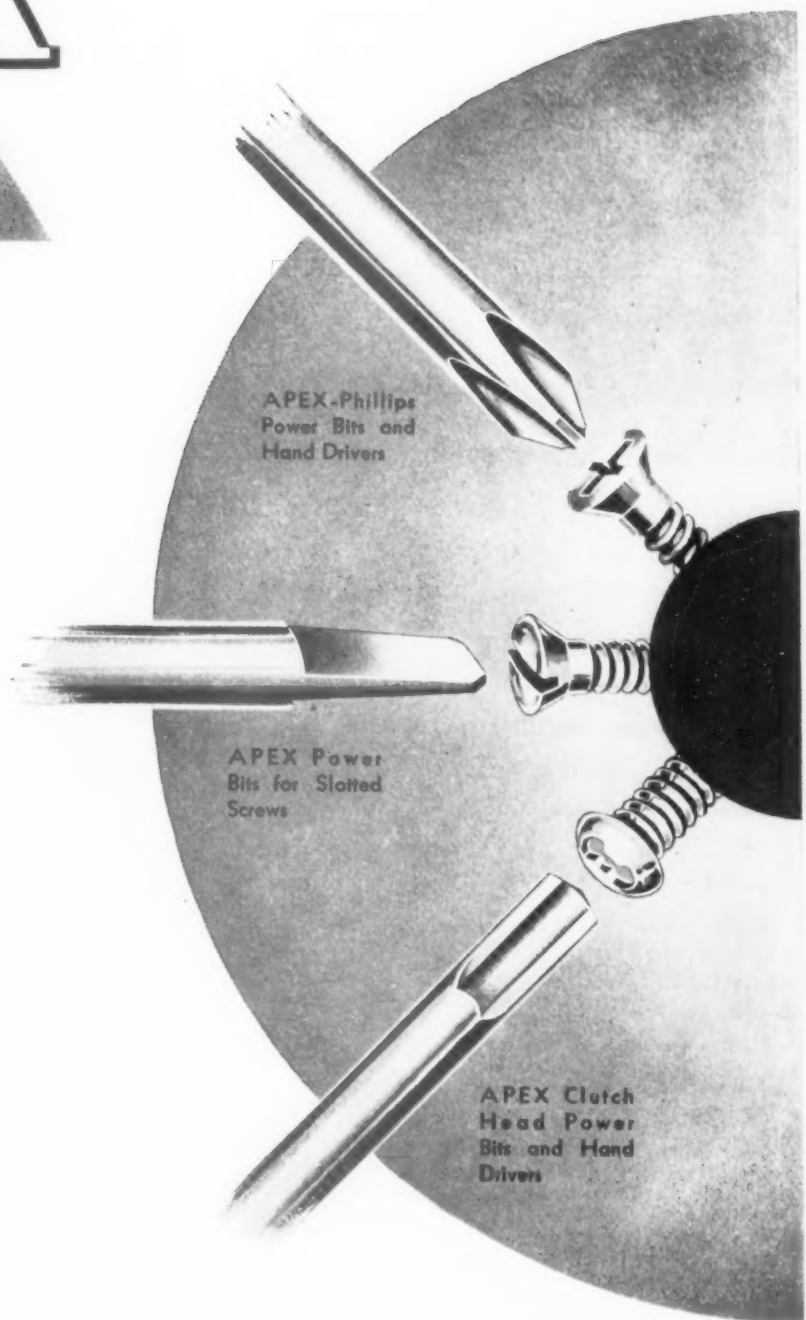
APEX Clutch Head Bits can be reconditioned by the user. As the Bit wears, it is only necessary to grind away the worn section. APEX Clutch Head Bits are made to accommodate several grindings. APEX Points—the Way!

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Dayton, Ohio



individual jobs today. And we know it in the history of the last two or three decades.

America's scale of living has resulted from the application of mass production methods, from cutting manufacturing time to lower costs.

We can realize that victory will be won through the accomplishment of Tool Engineering achievements such as raised that standard of living. In 1939, the assembly of the breech block of an anti-aircraft gun required three and one half hours. In 1942, it takes 36 seconds.

Counterboring holes in large aircraft engines required six and three-quarter hours last year. This year it is done in one hour and five minutes.

Drilling holes into an airplane engine cylinder consumed 420 machine minutes last year. Now, it is done in nine minutes. Machine gun bores were drilled one at a time last year. Today, six are bored simultaneously.

Fresh Water Facts

Basis of the entire war production program is steel. Without it the wheels

of industry would be stilled. And behind the steel industry itself lies the business of transporting iron ore from Minnesota's fabulous red ranges to unloading docks at lower lake ports. Shipbuilding on the Great Lakes, featured in a TOOL ENGINEER article this month, is one of the nation's critical industries. Without exception, it gets top priorities on all raw materials and machinery necessary to launch and outfit the sleek giants so badly needed to carry the red gold over the blue waters of America's inland seas.

This year all shipping records on the Lakes must be broken. Navigation opened a month early on Lake Erie, but none too early. The first day ice broke at the Soo Locks, a half dozen waiting ships were floated "up" to Lake Superior.

The Lakes fleet of 750 vessels is moving day and night. Before late December, some 300 American and Canadian ore boats will have to carry more ore than was ever thought possible. They will carry 100,000,000 tons, maybe more, between Duluth and Lake Erie ports 750 to 1,000 miles south. Last year they moved 80 million tons, 20 percent more than in the previous record year of 1929. From lower ports they carried 13,000,000 tons of coal to the northwest.

But last year's shipments will not be good enough for 1942. A record 7,000,000 tons of ore was melted in January and monthly consumption since has been exceeding last year's by more than 10 percent. By the time navigation closes, the rate of consumption will top 8,500,000 tons. Further complicating the picture is the need for a winter stock pile. So severe is the pinch that it has become necessary to ship coal northward by rail, rush boats back to Minnesota empty. Coal requires only three to five hours in loading, eight to 12 hours in unloading. That in a nutshell, is how important Great Lakes ore shipments are to Allied war production.

Award Winners

To the tool industry has gone the honor of receiving the first joint Army-Navy award for outstanding service in war production. Recipient of this signal honor were the Cleveland Twist Drill Company and the National Acme Company, also of Cleveland.

Colorful and inspiring, these presentations have proved effective employee morale builders. The Army-Navy flag is an outgrowth of the now famous Navy "E", longtime recognition for industrial achievement on marine work in wartime.

TANNEWITZ HIGH SPEED METAL CUTTING BAND SAWS

... a far Faster Means of Cutting

TEMPLATES

from SHEET STEEL up to 1/4"

NON-FERROUS MATERIALS

of all kinds up to 3" thick — see chart below

SAVE THEIR COST IN SHORT ORDER

These superb machines, delivering over two miles of saw blade travel per minute without vibration, are doing hundreds of metal cutting jobs in a fraction of the time previously required, in metal working plants of every description throughout the country. To increase production and make important savings get the details NOW! A line requesting Metal Cutting Band Saw Bulletin will bring them to you promptly.

KIND OF MATERIAL	1/2"	3/8"	1/4"	3/16"	1/8"	1/16"	1/32"
MILD STEEL	12-24	6-12	3-6	1-3	1-2	1-2	1-2
STAINLESS STEEL	6-12	3-6	1-3	1-2	1-2	1-2	1-2
YELLOW BRASS ZINC	24-36	12-24	6-12	3-6	1-3	1-2	1-2
BRONZE OR COPPER	6-12	3-6	1-3	1-2	1-2	1-2	1-2
ALUMINUM	24-36	12-24	6-12	3-6	1-3	1-2	1-2
DURALUMINUM	24-36	12-24	6-12	3-6	1-3	1-2	1-2
SINGLE PLYMETAL	24-36	12-24	6-12	3-6	1-3	1-2	1-2
DOUBLE PLYMETAL	24-36	12-24	6-12	3-6	1-3	1-2	1-2
PLYWOOD	24-36	12-24	6-12	3-6	1-3	1-2	1-2
ASBESTOS BOARD	12-24	6-12	3-6	1-3	1-2	1-2	1-2
FIBRE (HARD)	24-36	12-24	6-12	3-6	1-3	1-2	1-2
PAPER BOARD	24-36	12-24	6-12	3-6	1-3	1-2	1-2
PLASTER	24-36	12-24	6-12	3-6	1-3	1-2	1-2
BAKELITE	12-24	6-12	3-6	1-3	1-2	1-2	1-2

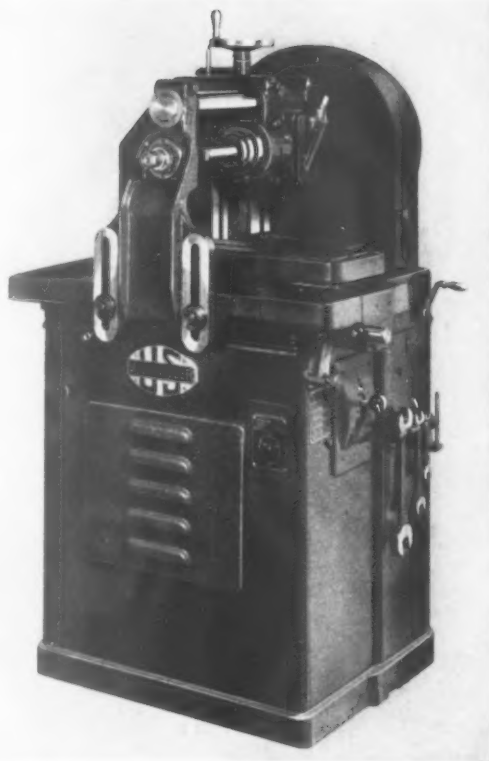


PERFECTLY SAFE: Two-wheel Lockheed Hydraulic Brakes automatically and instantly stop the wheels in case of saw blade breakage—completely guarded.

Incorporated in Tannewitz High Speed Band Saws are many highly developed, patented features found in no other band saws.

Made by Sawing Machinery Specialists

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U.S. *Multi* MILLERS produce vital parts for **AIRPLANE**

Cannon

U. S. MULTI-MILLER cam-operated table feed is largely responsible for the extreme versatility of this popular machine tool. This feature is explained and illustrated in detail in addition to all other U. S. MULTI-MILLER features, in the recently published Bulletin shown below. Send for your copy today.



The manufacture of Cannon for Airplanes includes a number of milling operations on various small and essential parts. These parts must be machined for interchangeability on a high production basis, and to a high degree of accuracy.

For operations of this nature the U. S. MULTI-MILLER is an ideal tool; it performs twenty-three different operations on this Cannon job including facing, angle milling, height milling, radii forming, single and multiple slotting, length cutting-off, etc. The versatility of the U. S. MULTI-MILLER comes in handy for war production of this nature—versatility coupled with automatic and precision features which make short lot jobs just as practical as long run jobs, which permit one inexperienced operator to easily handle a large battery of U. S. MULTI-MILLERS, which through a proven cam-controlled action, provide high speed and accurate index milling—high speed grinding—vertical milling—spur gear cutting—hand milling—automatic cut off—continuous milling of bar and coil stock—rotary milling—contour milling—climb milling—blind milling.



U. S. TOOL COMPANY, INC. Ampere (East Orange), New Jersey

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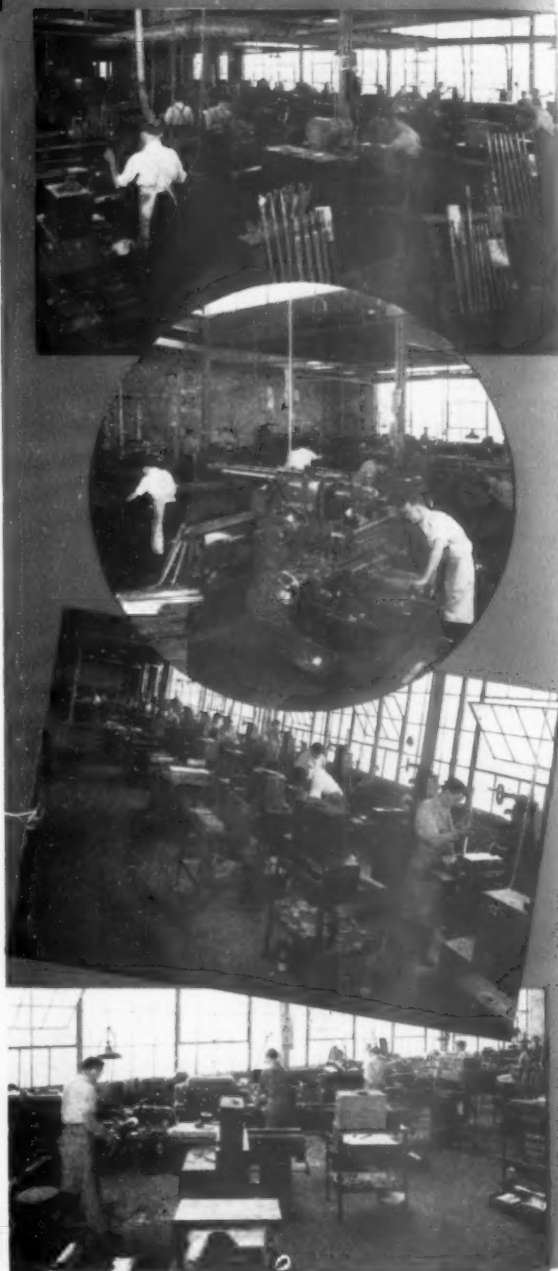


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WASHINGTON LETTER

By A. N. WECKSLER

Washington Correspondent for
THE TOOL ENGINEER

Production Requirements Plan
and the Allocations Classifica-
tion now in period of testing by
WPB.



CURRENT quarter is considered by War Production Board officials to be a period of testing to determine whether the Production Requirements Plan and the new Allocations Classification to designate end use will be the final Government material flow controls.

Admittedly, PRP is subject to change, and the Allocations Classification is an experiment. If the combination does not produce the desired degree of control, adaptation of the British warrant system has been suggested as a means of attaining the desired end.

Materials which are very scarce are already to a large degree under complete allocations control. The priorities rating granted under PRP will no longer be a rubber check on materials, but will only allow priority on a specific tonnage of material.

Determination of Priority

However, as material supply reaches a stage of scarcity where priority has to be determined as between two war end uses, WPB plans a correlation between the allocation of metal to the actual end product.

It is the WPB position that the civilian economy has been squeezed down close to the minimum level. Civilian industry which is still permitted is put on a "patch and pray" basis, with indica-

tions that materials will be available for minimum repair and maintenance needs, but that replacement of equipment will be difficult, and in some instances impossible.

Concentration of Production

There is increasing consideration being given to concentration of production among the most efficient producers, so that there will be a minimum of waste of critical materials. As converted industry gets into full production on war contracts, the rate of scarce material consumption will require a greater degree of material conservation.

The pinch will not reach a point of crisis until the latter part of this year, and then some final decision as to material flow control will have to be reached. It is planned to muddle through the current quarter with a combination of PRP, the Allocations Classification as an overall guide, and priorities ratings to designate the order of urgency.

WPB Maintains Close Check

While the system of controls will not be clearly defined during the next few months, WPB will maintain close check on all usage of copper, alloy steels and, alloying metals through the monthly

reporting forms required of producers. War industry requirements will be fully met, but civilian industry requirements will be arbitrarily cut.

WPB action restricting the type of steel which may be used in producing hand service tools — chisels, hammers, snips, pliers, punches, screw drivers and wrenches — indicates a marked trend toward prescribing the alloys which are to be used in specified end product manufacture. The shortage of alloying metals led to the further expedient adopted by the War Production Board of making the segregation of certain scrap alloy steels mandatory.

Segregating of Scrap

The objective of this latter action is to be able to determine the exact alloy content of scrap to be used in melting to produce steel, and in this way to save the usage of additional alloying metal. Mills previously segregated their scrap, and the action is mainly directed at fabricators.

Development of major concern to industry is the threatened shortage of skilled labor. While there is still unemployment in some areas — notably New York City and some non-defense areas — war industry has drained off surpluses in war industry centers, and the War Manpower Commission is planning

steps to guard against pirating of labor by competing employers.

Training Green Labor

In addition to the actual problem of obtaining labor, there is added the problem of training green labor. War Manpower Commission recommends increased hiring of women and Negro workers. The use of green labor leads to a higher percentage of material waste and tool breakage.

Office of Price Administration has adopted an elastic policy in control of war goods prices. Objective is to permit such latitude as is required to stimulate capacity output.

Civilian Industry

Actions covering civilian industry, however, are aimed at a stringent adherence to March price ceilings. Where dealer and retailer margins are not sufficient to meet the overhead and reason-

able profit requirements, OPA has rolled back the price on manufacturers, who have reduced their operating margins.

Manufacturers have been forced to compensate for their higher material and labor costs through a reduction in selling costs. This has been possible to a degree, as the market is clearly a sellers' market.

Trend Toward Standardization

OPA policy points toward a strict supervision of allowable profit margins, with a distinct trend toward standardization of product. In addition, simplification to the extent of bringing output down to a minimum utility level is under discussion.

Machine Tool Industry

WPB actions affecting the tool industry are as follows:

May 23 — Industry holding an inventory of primary copper and copper base alloy products still in the form in which they were received, and all other copper and copper base materials, required to file detailed reports with the WPB. Objective is to make available frozen stocks of copper for salvage.

May 25 — Amendment 5 to General Preference Order M-21 excepts merchant quality fence wire, woven wire fence, poultry netting, barbed wire, staples, fence posts, gates and corrugated roofing and siding from the restrictions on deliveries of iron and steel products except on an A-10 or higher rating.

May 26 — Steel for 90 mm. armor-piercing and semi-armor-piercing shot made subject to Order M-21-f, placing this steel under complete allocation control.

May 26 — General industrial equipment distribution brought under L-123, covering such machines as passenger and freight elevators, electric motors of more than one horsepower, industrial fans, industrial compressors and pumps, and other classes of machinery. Order provides that an A-9 rating or higher is necessary to obtain delivery, or specific authorization by the Director of Industry Operations.

May 27 — Production and distribution of many types of instruments, regulators and control valves used in industrial processing made subject to Con-

On the Level!

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A LEVELED MACHINE
DOES BETTER WORK
AND LASTS LONGER

Made in
Three Sizes:

No. 1—2" x 2 1/2" x 4 1/2"
No. 2—2 3/4" x 3" x 6"
No. 3—3 1/2" x 4" x 8"

PROMPT DELIVERY

For Accurate Leveling of Machine Tools, Large Surface Plates etc.

EMPCO Machine Jacks simplify the problem of leveling machines shifted for more efficient plant lay-out. No more cement base and floor bolts with their periodical shimming. Simply place EMPCO Jacks under each machine on your present floor, apply a wrench to the "hex" screw head and presto! . . . a level adjustment as precise as you want.

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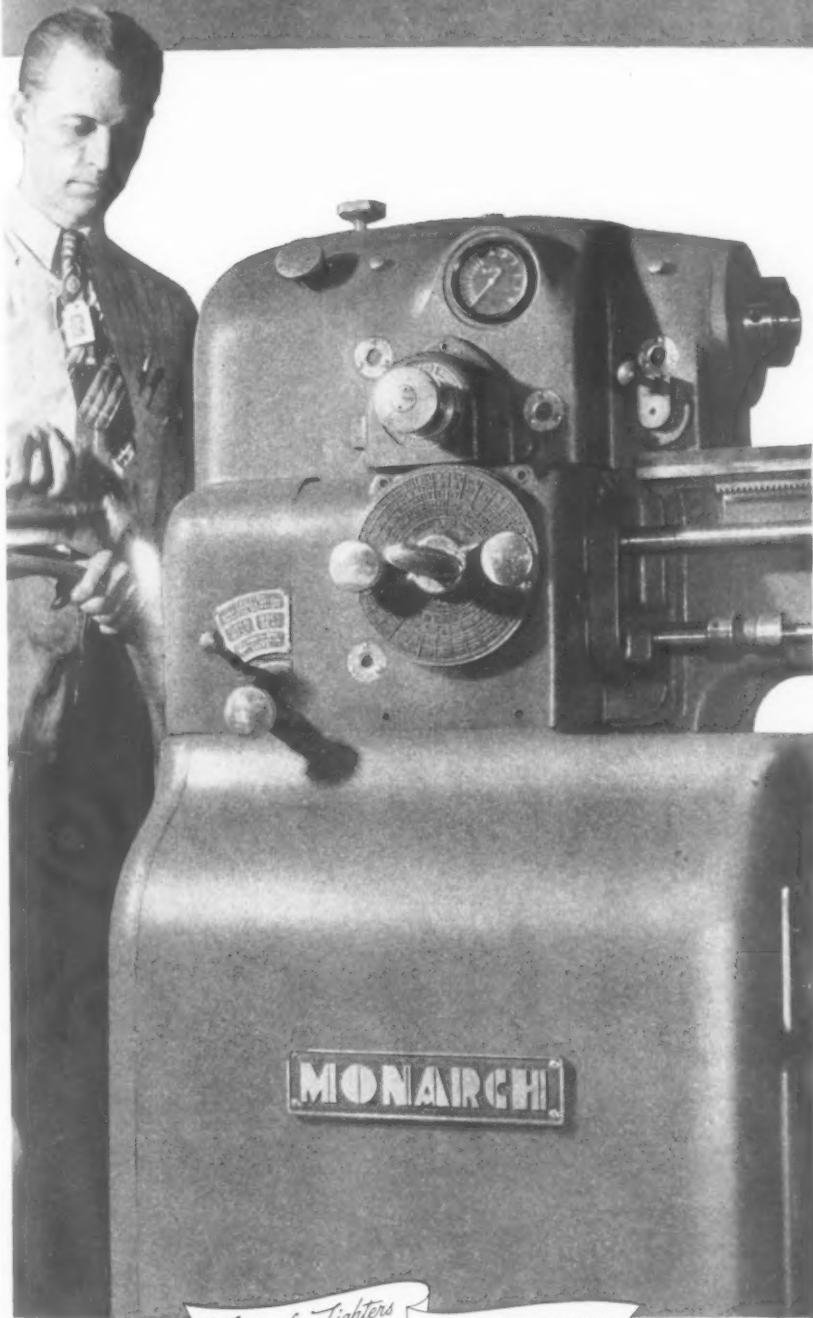


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WE'VE PUT ON "War Paint"



Faster for Fighters
WITH MONARCH LATHES

INDIAN WAR PAINT in brilliant colors gives way to today's program of stripping all nonessentials from our War effort. Complying with instructions from the War Production Board, Monarch and other machine tool builders are eliminating everything except protective painting, to save materials, man-hours and to quicken deliveries.

But under this changed surface, Monarch lathes perform just as efficiently as always. They are up in the front lines of our production effort, taking the burden of continuous operation in many plants—helping to deliver the implements of Victory, *faster for fighters*.

We promise you that when Victory is won and restrictions are lifted, we'll again make your Monarch lathes as handsome in their peacetime appearance as they will be useful in their peacetime performance.

THE MONARCH MACHINE TOOL COMPANY

SIDNEY . . . OHIO

MONARCH



LATHES

COVER THE TURNING FIELD

servation Order L-134. Size and chromium and nickel alloy content are restricted.

May 30 — General Preference Order M-20-a placing calcium-silicon under complete allocation control extended indefinitely.

May 30 — Director of Production William H. Harrison announced that the value of new machine tools, presses and other metal working machinery

shipped during April was \$114,100,000. Shipment of machine tool units totaled 25,415.

June 1 — Beryllium, alloying material used to harden copper, brought under complete allocation with issuance of Order M-160.

June 1 — WPB announcement of details of Allocations Classification System.

June 1 — Lead pool for June was set at 15 percent of April production.

June 5 — Amendment to Conservation Order M-43-a cuts percentage of tin to be used in miscellaneous permitted uses from 40 percent of the 1940 rate of use to 30 percent. Terms of amendment do not apply to production carrying a rating of A-1-k or higher, to bearing metal carrying a rating of A-3 or higher, to production of tin and ternary plate permitted under M-21-e, and to the use of solder under provisions of Conservation Order M-81 and M-86.

June 6 — Limitation Order L-145 provides that a producer of bearings may not accept any purchasing order for any sizes of anti-friction aircraft control and pulley bearings which he has not been specifically authorized to produce by WPB.

June 9 — Welding rods and electrodes subject to restrictions of Limitation Order L-146, which bans shipment of alloy rods or electrodes except on A-1-k or higher ratings. Other rods and electrodes are subject to an A-9 rating or higher.

June 9 — Cobalt-nickel oxide specified for use in the manufacture of "Ground Coat Frit" under terms of Amendment No. 1 to Conservation Order M-39-b. Use of the oxide as a protective coating is aimed at conservation of cobalt.

June 12 — Manufacture of chisels, hammers, metal-cutting snips and shears, pliers, punches, screw drivers and wrenches, restricted to use of low alloy steels under General Preference Order E-6.

June 15 — Distribution of gages, precision measuring tools, testing instruments and chucks made subject to a rating of A-9 or higher under General Preference Order E-5. General Preference Order 1-a revoked, with Order E-5 now applying.

June 18—Classifications of alloy steel scrap set up under M-24-c, making segregation mandatory. Action aimed at fabricators, as mills are now practicing such segregation.

Remember

Pioneer and
Forget
Your Coolant
and Lubricant
Problems



Today, with every effort being bent toward maximum output—you can afford to take no chances on any equipment that is not dependable.

With Pioneer Pumps on your machines you can forget the cooling and lubricating factors. These pumps have a recognized record for reliability, they require no attention by the operator. The coolant flow is always dependable—right from the moment the machine starts.

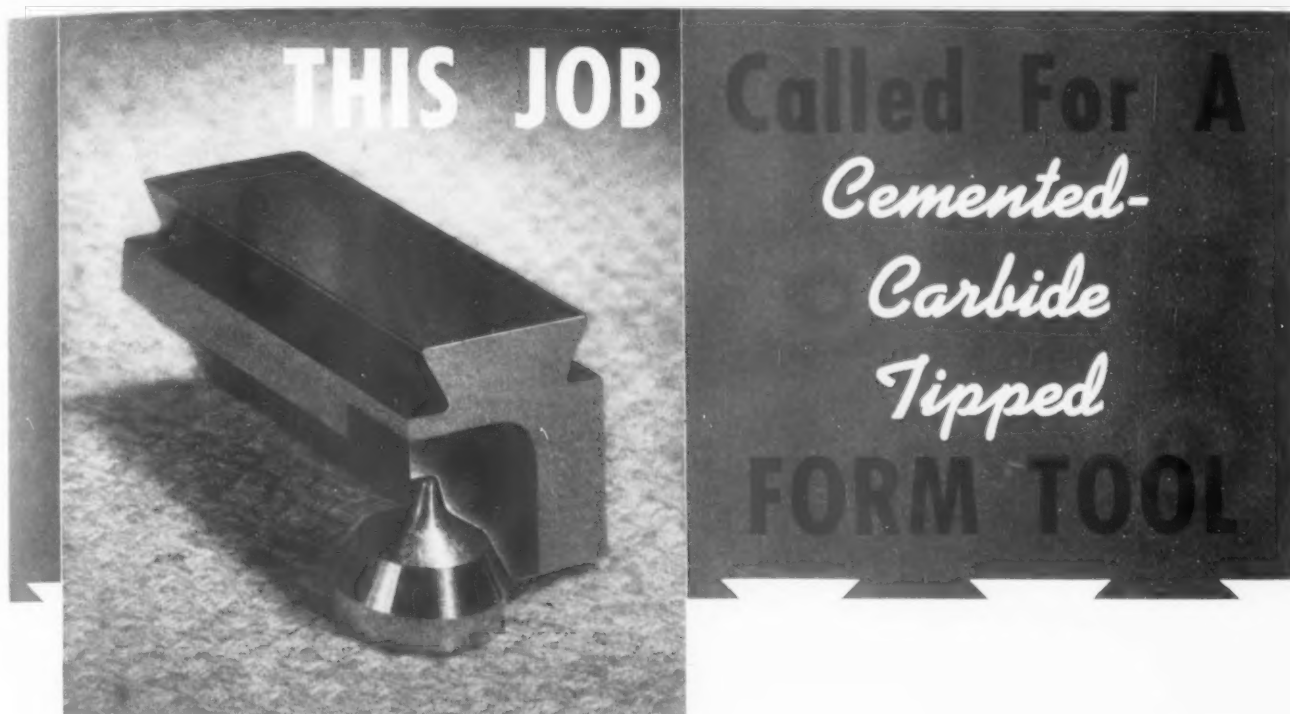
Pioneer Pumps are noted for their greater volumes with low power consumption.

With 375 standard types available, there is a Pioneer Pump to meet your particular requirements and bring highest efficiency to your machine operations.

PIONEER ENGINEERING & MFG. CO.

19645 JOHN R STREET

DETROIT, MICH.



THIS JOB

**Called For A
Cemented-
Carbide
Tipped
FORM TOOL**



Originally, these spray tips for Diesel injectors were formed with steel tools. Because of the constant wear on the tools, considerable difficulty was encountered in holding the form. In addition, it was necessary to polish the parts to secure the proper finish.

Carbide Fabricators have produced the cemented-carbide tipped tools now being used for this job. Tool replacement has been reduced tremendously... production of accurately formed parts has been greatly increased... and the forming operation alone provides the desired finish.

In your manufacturing operations, there undoubtedly are many jobs on which Carbide Fabricators special cemented-carbide tipped tools will produce parts faster and more accurately. Their exceptional economy in use has been proved many times over on high production work. Your inquiries regarding prices and deliveries will receive prompt attention. Blueprints should accompany each inquiry.

CARBIDE FABRICATORS PRODUCE A WIDE VARIETY OF SPECIAL CEMENTED-CARBIDE TIPPED CUTTING TOOLS AND OFFER A COMPLETE LINE OF STANDARD TOOLS.



Carbide Fabricators

**BERKLEY
MICHIGAN**

DIVISION OF MORSE TOOL COMPANY • DETROIT

A. S. T. E. DOINGS



Boston

108 members and friends attended the dinner and technical session of the Boston Chapter meeting held on the night of May 21st.

Main speaker for the evening was Mr. Glen H. Stimson, gage sales manager of the Greenfield Tap & Die Corporation of Greenfield, Massachusetts. Mr. Stimson discussed 6-inch vernier scales, fixed gaging, dial gages and precision measuring instruments. Mr. Stimson used motion pictures with his talk.

Among those taking part in the "gadget talks" at this May meeting was Robert E. Dow who gave a talk on radial shaping, a part known as a sinker cam. Other gadget talks were given by Mr. Lloyd Boynton of H. K. Porter, Everett, Mass. and Mr. Gilbert H. Tapley of the War Production Board.

Another feature of the evening was the colored movie shown by Henry Richards, entitled "Unfinished Rainbows," Part II.

Buffalo

The Buffalo-Niagara Frontier Chapter held its May meeting on the 21st at

1942-43 Toronto Chapter Officers



Seated left to right are: R. E. Crawford, Fred Schytte, J. B. McRae, and L. G. Singer. Standing: John B. Burk, E. N. Wearn, Roy N. Sherk, and Walter W. Appleton.

Members of National Committees Named

Otto W. Winter, national president of the A.S.T.E., announces the appointment of chairmen for the society's national committees. Also appointed at this time by president Winter are the seven area vice chairmen for each committee.

These seven areas are New England, Middle Atlantic, Southern, Middle West, Central, Western, and Canadian. Listed below are the president's appointments except several to be announced in August.

CONSTITUTION and BY-LAWS

Chairman: Robert M. Lippard

Area Vice Chairmen:

Irwin F. Holland
J. A. McMonagle
William Oswald
Ed. Dickett
Walter Wagner
Jack Marvin
Ed. L. Greer

EDITORIAL

Chairman: Andrew Rylander

Area Vice Chairmen:

C. J. Lindegren
A. H. Mitchell
H. E. Collins
Walter Ringling
Milton L. Roessel
R. R. Nolan
William A. Dawson

INDUSTRIAL RELATIONS

Chairman: Earl V. Johnson

Area Vice Chairmen:

W. W. Young
H. W. Barclay
H. T. Sprott
Ernest H. Nieman
G. J. Hawkey
Karl L. Bues
E. N. Wearn

NATIONAL PUBLICITY

Chairman: Joe Siegel

Area Vice Chairmen:

K. F. Thomas
E. C. Adams
M. M. Ross
William Iekel
Lou Weber
Arthur J. Denis
R. E. Crawford

NEW CHAPTERS

Chairman: To be announced.

Area Vice Chairmen:

A. H. d'Arcambal
Floyd W. Doty
Earl Kane

Roy T. Bramson
Henry A. Powis
Arnold Thompson

MEMBERSHIP

Chairman: To be announced.

Area Vice Chairmen:

Frank W. Curtis
H. Wilson Ryno
W. E. Burndrett
W. Z. Fidler
Herman A. Poock
Anton Peck
John W. Burke

STANDARDS

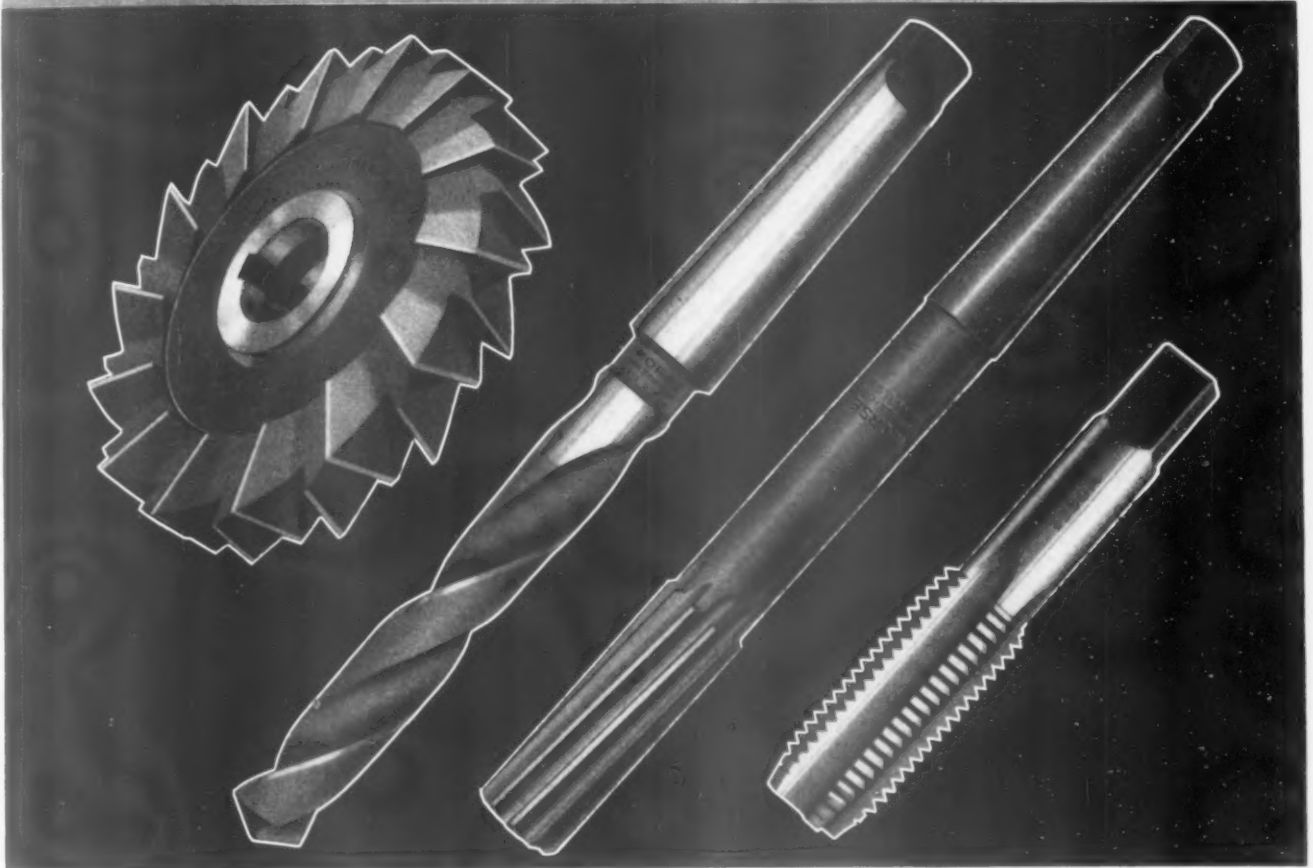
Chairman: E. W. Ernest

Area Vice Chairmen:

Leon F. Marsh
F. J. Rawson
John Thomas
Horace Wentzel
E. E. Griffiths
Floyd R. Cox
Robert B. Douglas

BOOST "MACHINE MORALE"

The best of machine tools become better ones — do more work, with greater precision, with fewer stops — when equipped with highest quality cutting tools.



MORSE

THERE IS A
DIFFERENCE

**TWIST DRILL AND
MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

the University Club. Over 100 members and guests were present for dinner, and more than 150 attended the technical meeting.

The speaker of the evening was Mr. J. P. Gill, Metallurgist of the Vanadium Alloys Steel Corporation and his subject, "High Speed Steel and its Applications," was illustrated by slides.

In his talk, Mr. Gill used comparative charts which covered tests of various combinations of the alloys that go to make up the types of high speed steel.

Cincinnati

The Cincinnati Chapter of the A.S.T.E. held its annual meeting at the Alms Hotel, May 16. Arthur C. Pletz, chairman, presided. The principal speaker was W. W. Finlay, plant manager of the Wright Aeronautical Corporation, Lockland Plant, Cincinnati, Ohio. His subject was "The Tool Engineer in War Production." Commander G. H. Bowman, U. S. Navy, in charge of the Cincinnati District on the inspection of materials, also spoke. Com-

mander Bowman's talk was, "Tool Engineer's Activity in the War Program." National officers attending this meeting included the national president, Mr. O. W. Winter, and the executive secretary, Mr. Adrian L. Potter.

Detroit

The Detroit Chapter held its final technical meeting of the season on Thursday, June 11, at Huyler's Concourse Dining Room in the Fisher Building. After dinner, Mr. Joe Siegel presented a report proposing that the Detroit Section become affiliated with the Engineering Society of Detroit.

The main speaker of the evening was Mr. S. C. Spaulding, technical consultant in charge of the Iron and Steel Branch War Production Board at Washington, D. C. His subject was, "Substitute Steels for Cutting Tools, Jigs and Fixtures." Mr. Spaulding showed slides comparing the old S.A.E. steels with the new national emergency steels and pointed out that the new steels covered fairly well the range of requirements.

In addition to the regular speaker, three films were shown. Mr. C. Way of Warner & Swasey presented a film entitled "Chips" depicting the program his company is conducting to train operators. "We work for Victory and Plan for Peace" was the name of a sound film presented by Mr. Ellis and Mr. Pfeiffer of the Allis-Chalmers Company showing the part Allis-Chalmers takes in the war effort. Also shown was a third film of the Curtiss-Wright Company which showed assembly line methods used in the manufacture of pursuit planes.

Hamilton

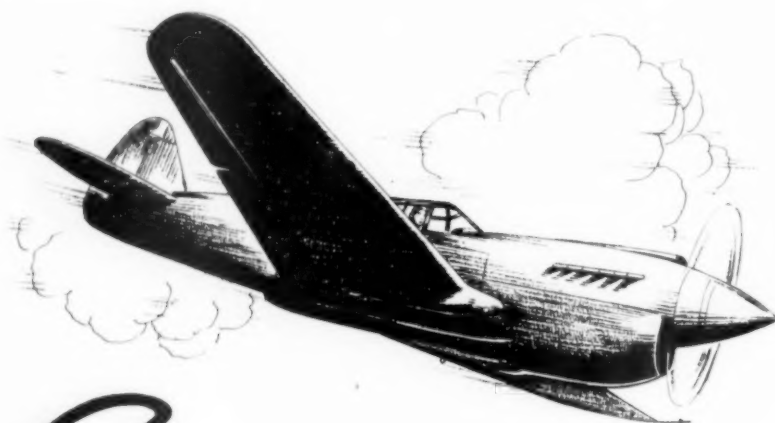
The Hamilton Chapter held its field day at Deer Park Golf Club, Grimsby, on Saturday, June 6th. Some 200 members and their friends attended this outing.

Indianapolis

The Indianapolis Chapter held its meeting on Friday, June 5, to plan for the coming year's business sessions and regular monthly meeting held on the last Thursday of each month.

Milwaukee

On Saturday evening, June 6, the Milwaukee Chapter held its sixth annual spring party in the Venetian Room of



Complete Industrial Engineering Service

Over 100 Engineers for

- Plant Conversion . . .
- Increasing Production
- Cost Estimates . . .
- Process Engineering
- Designing of Jigs . . .
- Fixtures, Gages, Dies
- and Special Machines

No Job too Large or too Small

OUR REPRESENTATIVE WILL
GLADLY CALL AT YOUR REQUEST

**AMERICAN DESIGNING
& ENGINEERING CO.**
6331 GRAND RIVER AVE. DETROIT, MICH.

GAGES THAT *Outwear* THEIR HANDLES



The gage handle at the left originally was identical to the new handle shown at the right. In constant service for about a year and a half, its surface has been worn round and concave by inspectors' hands.

This handle was used with only one 1 $\frac{5}{8}$ "-36 pitch Carbide thread plug gage produced by Lincoln Park. A new handle has been supplied and THE GAGE IS STILL ON THE JOB!

The exceptional wear-resistance of Lincoln Park Carbide and chrome plated gages can be of

particular importance on your high production jobs. Inspection accuracy is maintained over a long period of time—in many cases, more than fifty times that of the ordinary type of gage. In addition, because allowance for wear can be reduced considerably, these Lincoln Park gages can be specified very close to required limits. Your production departments get the benefit of full manufacturing tolerances—eliminating rejection of parts which may be completed almost to maximum limits and which could not be checked properly with gages in which ordinary wear allowance is incorporated.

OUR NEW CATALOG

is just off the press. Your copy will be supplied by any one of the following sales representatives or will be sent immediately upon request on your company letterhead.

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Engineering Sales Company
112 Portwood Street
Houston, Texas

Mr. Edwin L. Fry
531 Howard Street
San Francisco, California

General Tool Sales
3945 North Broad Street
Philadelphia, Pa.

Mr. Robert W. Gloyd
1217 East Third Street
Dayton, Ohio

Mr. Floyd Harris
66 Davidson Road
Worcester, Massachusetts

Mr. M. J. Lloyd
3797 Parkdale Road
Cleveland Heights, Ohio

Mr. O. A. Muenz
790 Broad Street
Newark, New Jersey

Mr. James S. Murray
R. D. No. 9, Station 16
Pittsburgh, Pa.

Mr. John A. Payton
561 Paramount Building
Los Angeles, California

Mr. W. H. Scheer
7430 Bruno Avenue
St. Louis, Missouri

Mr. Walter F. Stegner
20 No. Wacker Drive
Chicago, Illinois

Mr. J. Rolland Stewart
918 University Building
Syracuse, New York



LINCOLN PARK TOOL and GAGE CO.

LINCOLN PARK, MICHIGAN

the Astor Hotel. Among the guests at this party were national president, O. W. Winter; national secretary, Clyde Hause; national treasurer, Frank Crone; and Gene Bouton, regional director. Principal speaker of the evening was president Winter, who gave a historical sketch of the growth of the A.S.T.E. Also included in the entertainment for the evening was a floor show and a film entitled "Empire on Parade."

Northern New Jersey

The Northern New Jersey Chapter held its June 9th meeting at the Hotel Robert Treat in Newark, New Jersey. The principal speaker was Col. J. K. Clement, Deputy District Chief, New York Ordnance District Office. Col. Clement gave a talk on the problems of the Ordnance Department and how all of the Tool Engineers can help speed

the program along. To supplement his talk, Col. Clement, brought with him a moving picture showing the manufacturing of a 75 mm shell and the operations involved in production.

Pittsburgh

The Pittsburgh Chapter held its June meeting at McCann's Restaurant on Friday June 5th. 77 members and guests attended the dinner and heard Mr. D. H. West of the LaPointe Machine Tool Company speak on broaching machines and tools. The talk was illustrated with numerous slides.

Racine

The Racine Chapter celebrated its seventh annual frolic at the Meadowbrook Country Club on Friday, June 12th.

The festivities started at one o'clock in the afternoon with approximately 60 members participating in a golf tournament. W. C. Davidson won the honors of the afternoon by shooting the lowest score. Other members took part in a ball game that afternoon. Following the activities of the afternoon, a dinner was served attended by over 200 Tool Engineers. Toastmaster for the occasion was Mr. M. Joseph Clancy. Speakers at the dinner included Lt. Col. W. B. Hobbs, chief of the administrative division of the Chicago Ordnance District, and Eugene Bouton, chief engineer in charge of all regional offices of the War Production Board in the northwest district.

A moving picture of Mexico followed the dinner speakers, and movies of last year's frolic were shown by Gene Zimmerman of the Illinois Tool Co.

St. Louis

The St. Louis Chapter held its monthly meeting June 11th at the Hotel Melbourne. 17 guests from the Amertorp Company were present and 4 members of Chapter 14 also attended this meeting.

Mr. Sherman of the Shell Oil Company presented a sound movie showing a trip through the Research Laboratory of the Shell Developing Company.

San Diego

The San Diego Chapter held its May meeting on the 30th, gathering at a breakfast meeting. Considered something new in the way of meetings, this is the San Diego Chapter's way of get-

TOMKINS-JOHNSON
Air Powered
RIVITOR

Furnishes "air squeeze" action combined with automatic feed riveting for aircraft production. By using a different type of rivet set and jaw construction, Counter Sunk Head Rivets are handled as well as Flat Head, Round Head, Full and Semi-Brazier Head Rivets. For specifications, etc., write Dept. T.







Air Cylinders



Hydraulic Cylinders

EQUIPMENT
HELPS ATTAIN MAXIMUM
SPEED IN PRODUCTION

T-J AIR CYLINDERS

These units exert power movement from 100 lbs. to 12,000 lbs. (direct). Made in styles, sizes and strokes to meet your requirements.

T-J HYDRAULIC CYLINDERS

Designed and furnished in types and sizes to exert power movement from 1,000 lbs. to 50,000 lbs. (direct).

For Catalogs on these cylinders write Dept. T.

THE TOMKINS-JOHNSON CO.
Jackson • • • Michigan

Reset the Cutterhead Instead of the Work

**SAVE TIME
PREVENT ERRORS**



SPECIFICATIONS

No. 26 RAM-TYPE UNIVERSAL MILLER:

Table: 50" x 12"

Range: 28" longitudinal, 12" cross, 18" vertical

18 Speeds: 30 to 1500 rpm

18 Feeds: $\frac{3}{8}$ " to 32"

VAN NORMAN RAM-TYPE UNIVERSAL MILLERS substitute quick, mechanical "headwork" for a lot of slow and fussy handwork on the part of operators. To change from vertical to horizontal or angular milling, it is necessary only to unclamp, swing the cutterhead to the new position desired, reclamp . . . and proceed with the next cut. Combining these adjustments with movements of the ram in or out over the column, it is possible to carry many jobs straight to completion, without either resetting the work on the table, or detouring it to another machine. This means that risk of error is minimized, spoilage of critical materials reduced, and that more time is employed in actual productive work. Also, it means that new men can be more quickly trained to adequate competence, because of this exceptional ease and convenience of operation. Add to these advantages the strength and rigidity which are the final safeguards of Van Norman accuracy, and you can see why Van Norman Ram-Types are the outstanding toolroom and short-run production millers in America's war industries.



VAN NORMAN MACHINE TOOL CO.

SPRINGFIELD, MASS.

ting day and night workers together for A.S.T.E. meetings.

At this meeting, Mr. W. O. Fritz, was installed as the new vice-chairman.

Principal speaker at this meeting was Mr. Brandt, of Brandt, Inc. His talk concerned production processing and tooling for efficiency.

Golden Gate

The regular monthly meeting of the Golden Gate Chapter was held at Bel-

lini's Cafe in Oakland on Tuesday, May 19th and was attended by 112 members and guests.

Following a brief business meeting, a sound motion picture called "Building a Bomber" was shown. This picture showed the many complex operations in the manufacture of a bomber, the thousands of parts needed and also the many assembling jigs.

Principal speaker of the evening was Mr. W. P. Collins, District Manager,

Contract Distribution Branch, W.P.B. Mr. Collins' subject was "America Must Convert." He explained the urgent need of conversion of plants either large or small to the manufacture of war needs.

The second speaker of the evening was Mr. Harry H. Daley, Priorities District Manager, W. P. B., whose subject was "Priorities."

Schenectady

The Schenectady Chapter held its meeting at "Ten-o-One" Veteran's Memorial Hall at Scotia, New York, on the evening of May 21st. 150 members and guests were present for this final meeting of the year, which was a combination "Victory" meeting and ladies night.

The speaker of the evening was Mr. Lawrence H. Hawkins, executive engineer of the Research Laboratory of the General Electric Co. Mr. Hawkins spoke on the part which research is playing in the present war as compared with World War I.

At this meeting the newly elected Chapter officers and committee chairmen were introduced. Among the other speakers were Capt. Orren of the British Army, Mr. B. G. Tang, superintendent of the Schenectady Works of the General Electric Company and Mr. H. E. Linsley of the Wright Aeronautical Corp., who showed films on the Wright Cyclone 14 cylinder radial aircraft engine.

South Bend

The South Bend Chapter held its meeting on the night of Friday, June 12th at the Indiana Club.

A film entitled "The Magic of Modern Plastics" was shown by the Breskin Publishing Corporation, and depicted new plastic products and dies for their manufacture. A display of plastic products was shown and two complete series of deep drawn shells.

Toledo

The monthly meeting of the Toledo Chapter was held at the Toledo Yacht Club on the night of Tuesday, May 19th. 52 attended the dinner served at 7 P.M.

Following the dinner, Mr. Wm. Oldacre, president of the D. A. Stuart Oil Company, Chicago, gave an illustrated lecture on "Cutting Fluids as a Factor in Tool Design." An open discussion followed the lecture.

THE TOOL ENGINEER

McCROSKY

Time-Cutters

**ON MULTI-OPERATION
DRILL PRESS JOBS**

WIZARD

Quick-Change Chuck

**AND
COLLET
OUTFIT**

WIZARD

COLLETS
HOLD TOOLS
RIGID AND
CENTERED

ASK FOR --
McCROSKY BULLETIN 15-D

EST.
1904

McCROSKY

TOOL CORPORATION

MEADVILLE
PA.

COST
CUTTING
TOOLS

**IMPROVE AND PROTECT
YOUR PRODUCTION**



**CHANGE TOOLS
WITHOUT STOPPING
THE SPINDLE**

Cut Cost

McCROSKY

Cut Time

SUNNEN Solves Another Problem

The Job

Collet — .305" hole, hardened.
Stock removed .002". Tolerance — Minus .000" plus .001"
Finish — 2 to 3 micro-inches —
practically all parts tested on
Brush Surface Analyzer for micro
finish and inspected under Com-
parator. Previous method used
— hand lapping.

Time saved by Sunnen Honing
— 35%.

"Since installing our first Sunnen
Honing Machine we have con-
stantly added more and more
parts to pass through the honing
process. We now have six ma-
chines in use."

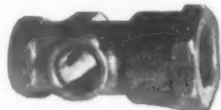
— Fidelity Machine Company



**SUNNEN HONING provides
a finish of 2 to 3 micro-inches
— and at a saving of 35% in time!**



Airplane Engine Parts accurately honed
to a super-smooth finish.



Bronze Valve. The Sunnen method of
honing is used to secure a high finish
and accuracy.



Aviation Hydraulic Cylin-
der made of Aluminum-
Alloy. Improves the qual-
ity of the bearing surface.
An extremely smooth
surface-finish is secured.

Aircraft
Valve Tap-
pet Roller.
4-Micro
finish.



"Produced on extremely accurate and
glass-like finish."



Diesel Engine Fuel Injector Cylinder
"So accurate that a piston can be fit
within .00005 inch."

Accuracy — and a super-smooth finish with a real increase in production which means a saving in cost. That's the record of the Sunnen "MA" Precision Honing Machine in the modern plant of the Fidelity Machine Company.

This one example is indicative of the many reasons why hundreds of leading manufacturers handling important war contracts have adopted Sunnen Honing.

Consider These Advantages

Wide range — handles internal diameters of .185" to 2.400". Accuracy within "one-tenth" guaranteed — has been held to .000025" on production jobs. Relieves big internal grinders for other jobs. Corrects errors of out-of-roundness or taper caused by previous operations. Facilitates duplication of sizes. Does not require skilled labor. Practical — inexpensive — economical to operate.

Put Sunnen Honing to work in your plant!

SUNNEN PRODUCTS CO., 7932 Manchester Ave., St. Louis, Mo.

Canadian Factory, Chatham, Ontario



Send for FREE BULLETIN

— Giving complete information. Or, if you prefer, a Sales Engineer will call and demonstrate this equipment in your plant, on your job.

SUNNEN

Tri-Cities

The Tri-Cities Chapter of the A.S.T.E. held its June 3rd dinner meeting at Olive Singer's Home on Rock River. More than 100 members and guests were in attendance.

The first speaker of the evening was Mr. Max Sklovsky, chief engineer of Deere & Company, who, in a coffee talk, traced the history of tools from the hammer and chisel to the present special machine tools. He said that the requirement for interchangeable parts in mod-

ern machinery created the need for close tolerances which in turn brought about the need for fixtures, dies, and special tools.

The technical session was featured by an informative talk by Mr. Gordon T. Williams, Metallurgist of Deere & Co., whose subject was "Getting the Most Out of Tool Steels." He pointed out certain characteristics of tool steels which the tool designer should keep in mind, and, through picture slides, illustrated the effect which notches and finish had

on fatigue strength of modern tool steels.

Williamsport

The Williamsport Chapter held its monthly meeting on the night of June 8th at the Evangelical Church.

At this meeting, Mr. Etham Vars, Titan Metal Company, Bellefonte, Pa., was elected as the new Chapter Chairman.

Chief speaker of the evening was Mr. G. Henry Sandborn, chief field engineer of the Fellows Gear Shaper Company. Mr. Sandborn talked on "Gearing in Defense", which covered the cutting of gears, gear blanks and their importance as to true faces, bores and outside diameters, the importance of rough and finishing the gear as two operations. He also brought out the importance of combining the automotive and aircraft methods of production. 80 members were present at this meeting.

KILLED IN HAWAII

Rochester Chapter member Lt. Oliver W. Boesch Jr., was killed in an accident May 16, while on duty in the Hawaiian Islands. Previous to his service in the army, Lt. Boesch was with the Yawman & Erbe Mfg. Company.

Hartford

The Hartford Chapter turned out 450 strong for its June 1 meeting held at the Hartford Club. Following the dinner, Frank W. Curtis, past president of A.S.T.E., and William A. Purtell, president of Holo-Krome Screw Corporation and Billings & Spencer Company, shared the speaking honors. Last monthly meeting of the current season, this was Executives' Night and after the speeches a program of vaudeville acts was given.

NEW BOOKS

Magnetic Tools and Appliances in Engineering Production by E. Molloy, \$2.50. Chemical Publishing Company, Inc., 229 King Street, Brooklyn, N. Y.

This book deals with the applications of magnetism in up-to-date engineering works. These applications are: magnetic chucks, magnetic clutches, lifting magnets, magnetic brakes, magnetic separators, and equipment designed for the magnetic detection of flaws in engineering materials.

These applications have been dealt with in detail in the book and should be useful to production engineers and works managers.

TOP QUALITY

... means Greater Efficiency

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THREAD GRINDER CLUSTER TYPE SINGLE MOUNT

★ Christensen has always stressed quality in the selection of diamonds. Our policy insures the maximum service from each diamond tool and saves your valuable machine time for essential production. The finest of Brazilian and African diamonds are selected for shapes and sizes best suited for your diamond tool requirements.

Diamonds selected are mounted by Christensen's Brostite Process into a

permanent matrix of powdered metal alloy.

Standard types of tools are carried in stock for immediate delivery. Send your diamonds to us for resetting in our new Brostite mounting. We will ship them within 24 hours.

To assist you in selecting diamond tools for performance and economy, Christensen offers, without obligation, the services of their qualified engineers.

★ Send for our new illustrated folder which gives you full information about industrial Diamonds. Wire or write today!

Christensen
Diamond Tool Co.

3687 East Willis Street

Detroit, Michigan

Standardize on this Analysis DBL High Speed Steel

Here's Why!

1. DBL meets the tungsten supply situation and conservation orders; it is a tungsten-moly steel containing less than 13 as much tungsten as 18-4-1.
2. It matches or out-performs 18-4-1 in nine out of ten cases.
3. It heat-treats virtually the same as 18-4-1, requiring only a slightly lower hardening temperature.
4. In hardening DBL, no coating is required.
5. It does not de-carburize; gives no "soft-skin" troubles.
6. Tools are made from it to the same machining and grinding tolerances used for 18-4-1.
7. DBL costs 16% less than 18-4-1.
8. It weighs 8% less, giving you more tools per pound.
9. Free patent license is offered, without time limit or other strings.
10. Under such licenses, DBL is produced by leading tool steel manufacturers. It can be identified as follows:

Analysis

C	.75	—	.85
Cr	3.50	—	4.50
W	5.00	—	6.00
Mo	4.00	—	5.00
V	1.25	—	1.75

ALLEGHENY LUDLUM

STEEL CORPORATION

PITTSBURGH, PA.

Tool Steel Division



Watervliet, N.Y.

Allegheny Ludlum Steel Corporation T-239
Oliver Building, Pittsburgh, Penna.

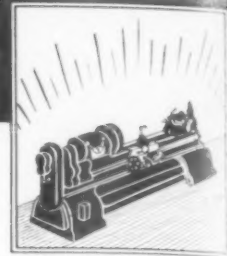
Send me a copy of the "DBL Blue Data Sheet."

NAME _____

COMPANY _____

ADDRESS _____

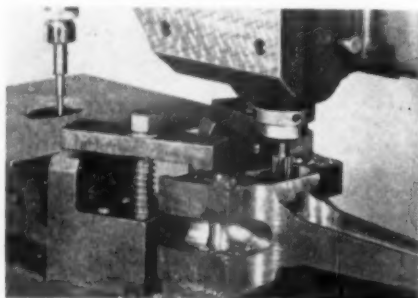
NEW EQUIPMENT, Materials, Processing



CONTOUR CONTROL (H1) FOR MILLING MACHINES

Known as the "Duplimatic", a semi-automatic control for machine tools, that permits contour machining with standard machine tools at speeds and accuracies considered beyond the capacity of a human operation, is being manufactured by The Detroit Universal Duplicator Company.

The manipulation of feed screws by



**Duplimatic
Control
Contour
machining
with
standard
tools.**

the Duplimatic control is in accordance with the outline of a template which is mounted on the table with the work. Thus, the cutting tool mills along a path identical with the template as shown in the insert in the illustration above.

The illustration shows the work mounted with a template fastened to the table beside it. A tracer mechanism is mounted on the head of the mill and remains immovable as does the cutting tool. This tracer is connected with the Duplimatic control so that during the operation the Duplimatic moves the table. Therefore, the template is always touching the tracer finger with a predetermined and exact amount of pressure.

NEW METAL FORMING MACHINE (H2)

A metal forming machine said to reduce labor time and costs associated with forming extruded sections to various shapes has been announced by the Southern Engineering Company, Inc., Los Angeles.

This machine consists of two basic sections. One is the movable head onto which the dies are bolted, and the other is the air ram to which the mating die is attached. A 5 hp variable speed reversible transmission system drives the head, through reduction gears and a pinion system, at an infinite range of speeds between 91 and 275 inches of travel per minute.

By attaching one end of the straight section to the movable die and then

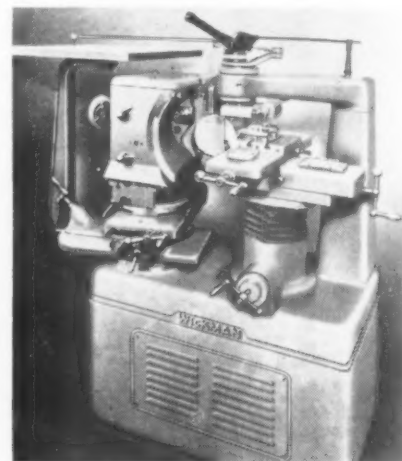


drawing it between the movable die and the die block located on the air ram, the formation of straight extruded sections, which may involve any number of changes in plane as well as profile, is

accomplished.

OPTICAL FORM GRINDER (H3)

Said to incorporate a number of features never before offered in a machine

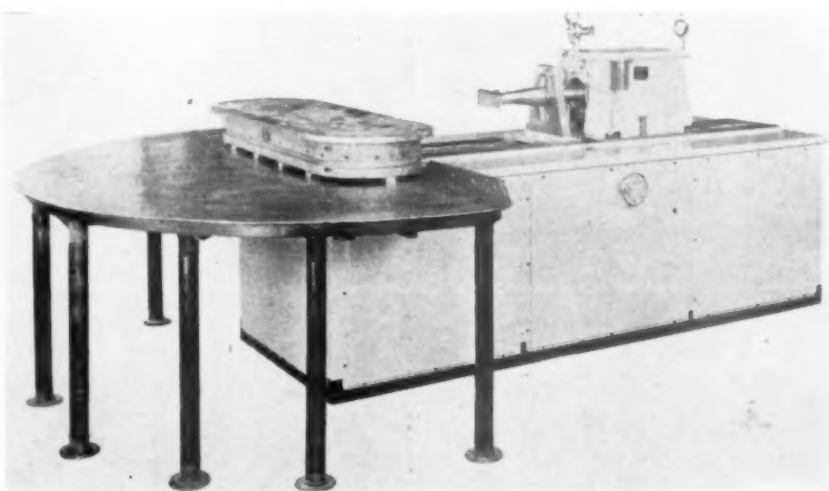


**Wickman Form Grinder
Has optical checking device.**

of this type, a new form grinder has just been introduced by the Wickman Corporation, 15533 Woodrow Wilson Avenue, Detroit.

It is claimed that this new grinder will finish grind to a very high degree of accuracy any flat or circular form tools, punches and dies, profile gages, and templates. It is said to be particularly adaptable to the grinding of tungsten carbide but is equally adaptable to hard tool steels.

The machine combines a full univer-



**Southern Engineering's New Metal Forming Machine
Forms extruded sections of metal to various shapes.**

FREE INFORMATION and SERVICE

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THREE FREE SERVICES ... WITHOUT OBLIGATION

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Simply fill out the card, indicating the information or service you desire, and mail. Be sure to write, in the square, the identifying number of the catalogs or bulletins covering new products described. In answering an advertisement, include the name of the advertiser and indicate by a cross if literature is desired or if company representative should call. No stamp is required.



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<p>Write in square, number of item describing one catalog wanted → <input type="checkbox"/></p> <p>NAME _____</p> <p>COMPANY _____</p> <p>ADDRESS _____</p> <p>TITLE THE TOOL ENGINEER, JULY 1942</p>	<p>Write in square, number of item describing one catalog wanted → <input type="checkbox"/></p> <p>NAME _____</p> <p>COMPANY _____</p> <p>ADDRESS _____</p> <p>TITLE THE TOOL ENGINEER, JULY 1942</p>
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<p>PAGE NO. _____</p> <p>NAME OF ADVERTISER _____</p> <p><input type="checkbox"/> Literature <input type="checkbox"/> Have Representative Call</p> <p>NAME _____</p> <p>COMPANY _____</p> <p>ADDRESS _____</p> <p>TITLE THE TOOL ENGINEER, JULY 1942</p>	<p>PAGE NO. _____</p> <p>NAME OF ADVERTISER _____</p> <p><input type="checkbox"/> Literature <input type="checkbox"/> Have Representative Call</p> <p>NAME _____</p> <p>COMPANY _____</p> <p>ADDRESS _____</p> <p>TITLE THE TOOL ENGINEER, JULY 1942</p>
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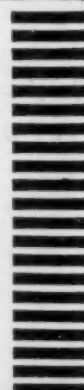
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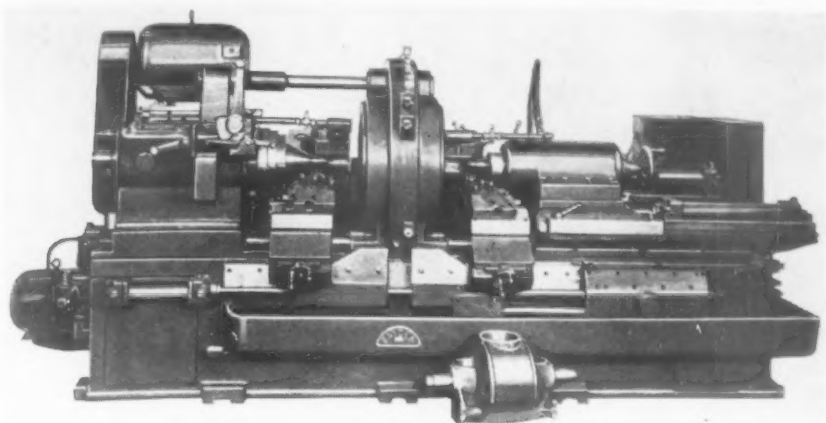
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Snyder Hydraulic Turning Machine
Features hydraulic feed from single power unit.



Dalzen Thread Grinder
Includes a splashing guard.

sal tool grinder with a pantograph controlled optical checking instrument. The wheel slide on the grinding head moves up and down at 80 strokes a minute across the contour of the part to be ground. The work is clamped to the table and its position controlled and set by compound slides.

THREAD GRINDER

(H4)

The grinding of threads up to 4 inches in length anywhere on an 8 inch

shaft with a diameter maximum of three inches is one of the features of a thread grinder being manufactured by the Dalzen Tool and Manufacturing Company, Detroit.

This machine is made with a guard which protects the operator from splashing oil and cutting fluids. The head of this grinder is constructed in a vertical position and thus is always exerting a downward pressure directly over its base.

It is said that this machine takes little more than half the floor space formerly required for the production of ground threads. It measures 39 inches deep, 43 inches wide, and 72 inches high.

HYDRAULIC TURNING MACHINE

(H5)

Featuring hydraulic feed operated from a single hydraulic power unit, a heavy-duty, double-end hydraulic turn-

ing machine is being built by the Snyder Tool and Engineering Company, Detroit.

Claiming a production increase of 65 percent, the control for the entire machine consists of a stop and start push button, a cycle start push button, and an emergency return. These controls are mounted on the center drive, directly in front of the operator.

The right hand tool bracket of this machine, when swung into clearance position, provides a loading platform in line with the locating surface in the center drive.

One of the features of the hydraulic system is the actuating of the front and rear tool slides. A single cylinder is used to cam the two front slides into position, at which point the cams stop moving and the tool slides are traveled through their work cycle.

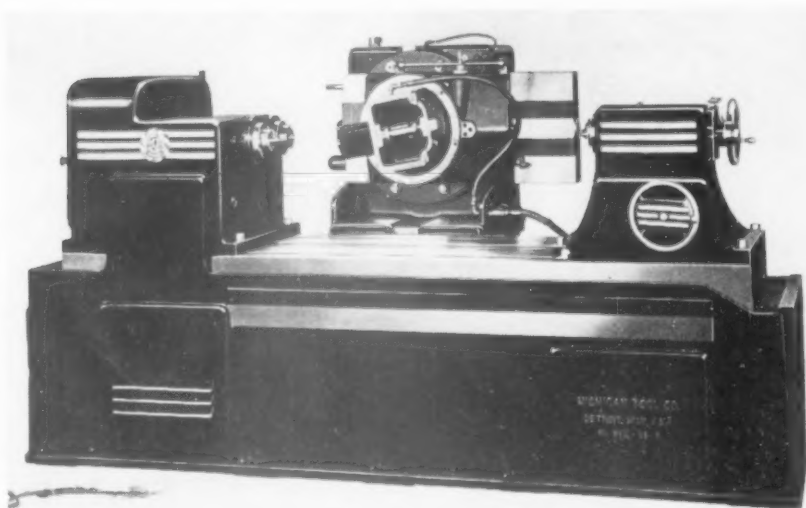
ROTARY GEAR SHAVER

(H6)

Equipped with two driving spindles and said to be capable of handling gears up to 36 inches in diameter, a new rotary gear shaver is now being produced by the Michigan Tool Company, Detroit.

This machine utilizes the crossed-axis principle of gear finishing. Work is driven, the cutter in engagement with the gear "following" the gear.

Three methods of finishing gears are available in the new machine. Wide capacity is claimed for this machine and gears as small as 4 inches in diameter can be handled with cutters down to 8½ inches in diameter. Maximum cutter face width which can be used is 6 inches with a maximum diameter of 12 inches. The spindle nearer the cutter handles gears from 4 to 18 inches in di-



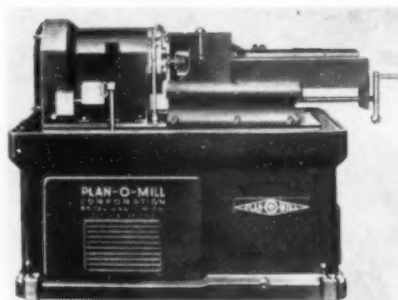
Michigan Tool's New Rotary Gear Shaver
Handles gears up to 36 inches in diameter.

ameter, while the farther spindle is suitable for gears from 18 to 36 inches in diameter.

PLANETARY MILLING MACHINE

(H7)

The Plan-O-Mill Corporation, formerly the Gordon R. Company, Royal Oak, Michigan, announces an improvement which involves the use of a General Electric Thy-mo-trol feed control on their Model 3 Plan-O-Mill. Built into this standard planetary milling machine, this device converts alternating



Plan-O-Mill Milling Machine
Uses Thy-mo-trol feed control.

current into direct current and provides an infinite and stepless range of feed by regulating the flow of current to the feed motor. Changing of gears and sheaves is said to be unnecessary.

This milling machine is designed for internal and external, right or left hand threading and form milling.

MILLING SPEED CALCULATORS

(H8)

Designed to make it possible for the operator of Cincinnati dial type milling machine to select the correct spindle



Cincinnati Speed Calculators
Selects correct speeds easily.

rpm for any combination of work and tool materials and cutter diameter, a built-in milling speed calculator is a new feature of Cincinnati milling machines made by the Cincinnati Milling Machine Company, Cincinnati, Ohio.

This calculator is, in effect, a circular slide rule and no knowledge of mathematics is needed. It consists of one stationary disc and two rotatable discs. On the periphery of the stationary disc are scaled various cutting speeds from 20 to 4000 feet per minute. On the top of the larger movable disc cutter diameters are given and on the bottom of the disc the cutter revolutions per minute appear.

VERTICAL BENCH MILLING MACHINE

(H9)

Incorporating precision taper roller bearings in the spindle and guaranteed by the manufacturer to have a run out of .0003, a new precision vertical bench milling machine has been announced by the Duro Manufacturing Company, 800 East 61st Street, Los Angeles.

Said to be equally adaptable to the tool room and high speed production lines, this milling machine has an one

Regrind Even Scores of Times

Today, the most solemn issue is Unity of Purpose. Adaptability becomes a blessing. Duty is intensified by facts. Production persistently heads the worksheet. And "save" is an hourly command.

With the spirit of conserving STEEL, TIME, LABOR and MONEY, the Severance Tool Company increasingly serves the Metal, Wood, and Plastic Industries with Small Rotary Power Tools for Fitting and Finishing. Supplanting ordinary Rotary Files, MIDGET MILLING CUTTERS in standard shapes and sizes are available with little or no delay. Cooperate with National Needs by ordering less than you believe you require; then enjoy at least an equivalent compensation, plus hidden savings through "Regrinding", which removes only about .004 of an inch.

Regrinding revolutionized the field of Rotary Files and Severance has regrinding histories of upwards to the unheard-of figure of eighty times. Contact Severance and try a cutter. These are trying times.

"Chatterless" Countersinks, Tube Deburring Cutters, and Engineering Service for Special Tools also await your request. Pacific Coast users and Prospects may address Severance Tool Company, 3844 South Santa Fe Avenue, Los Angeles, Calif.



SEVERANCE TOOL COMPANY

1522 East Genesee Avenue
Saginaw, Michigan

MIDGET MILLING CUTTERS
"Ground from the Solid After Hardening"



"EVEN TODAY . . .
DELIVERIES
ARE
PROMPT!"

MILFORD PROFILE SAW

... for all contour-sawing,
jig and band saw machines

More Profile Saw is being made and shipped than we thought possible a year ago. Our greatly increased capacity is taking care of the demand, and you don't have to wait long for deliveries.

Remember . . . when you use Milford Profile Saw you've got the best there is. It's the perfected product of specialists, with over a half century's experience behind them. Specialists who originated, and are the world's largest producer of, Profile Saw!

Order from your Mill Supply Distributor



Are you taking full advantage of the savings in time, money and basic equipment possible with Profile Saw? If you have a band saw machine it can be easily adapted to profile sawing. Write us at once for directions and a free sample of MILFORD PROFILE SAW, giving description of cutting job and machine.

THE HENRY G. THOMPSON & SON COMPANY
NEW HAVEN, CONNECTICUT
Also makers of MILFORD REZISTOR HACKSAW BLADES

JULY, 1942



... it wouldn't frighten you—neither will you be afraid to weld broken dies and tools when you use Eureka Tool Steel and Alloy Welding Rods. We can give you full instructions as to the proper rod for each and every job and fully acquaint your welding department with correct procedure upon receipt of your inquiry.



WELDING EQUIPMENT & SUPPLY CO.

222 Leib St.
DETROIT, MICH.

piece solid spindle support arm that is equipped with an adjustable graduated dial and index pin. Adjustments can be made to 60 deg. each side of center.

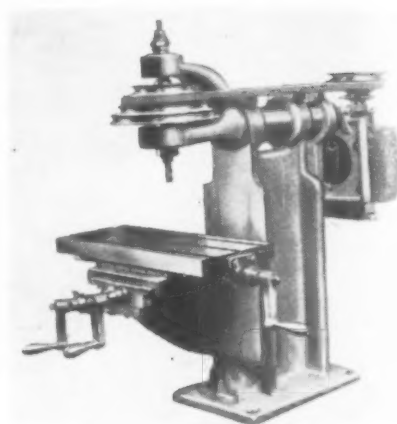
Splined disengageable handles operate micrometer adjustments for each direction of the table movement of which the vertical travel is 7 inches, longitudinal travel 8 inches, and transverse travel 5 inches.

BENCH MODEL TURRET LATHE (H10)

Said to be well adapted to second

operation work, a new bench model turret lathe has just been announced by the South Bend Lathe Works, South Bend, Indiana. Designed for rapid production to close tolerances on chucking operations or bar work, this lathe has a 10 inch swing over the bed and saddle wings, 1 3/8 inch hole through the headstock spindle, and an 1 inch collet capacity.

Having an adjustable stop for each of the six turret faces, the handlever operated bed turret indexes automatically. This lathe is equipped with both



Duro Milling Machine
Has one-piece spindle support.

a compound rest cross slide and a hand-lever cross slide, which are interchangeable.

A quick change gear box supplies 48 longitudinal power feeds for the universal carriage, 48 power cross feeds for the compound rest cross slide, and 48 thread cutting feeds, 4 to 224 per inch. The underneath motor drive and back gears deliver twelve spindle speeds, from 97 to 700 rpm.



South Bend Bench Lathe
Adapted to second operation work.

AIR CLAMP (H11)

Designed for use on T-slotted tables, particularly with fixtures so designed that horizontal pressure will hold the work, this new air clamp made by the Mead Specialties Company, 15 South Market Street, Chicago, is claimed to be rigid, compact, and powerful.

If needed, special bell-cranks or levers, pivoted on a separate fixture on the table, may be used to alter the direction of thrust—up, down, or at an angle.

Another model of this clamp may be

MACHINE TOOLS USED FOR CIVIL WAR MONITOR JOIN IN ALL-OUT PRODUCTION

WASHINGTON, Feb. 26—(INS)—The Monitor long since gave up the ghost, but the machine tools that built the Civil war "Ironclad" are producing for their fourth war.

In a shop at Providence, R. I., a huge, old planer that smoothed the deck plates for the Monitor—fore-runner of today's steel dreadnaughts—is working away on equipment used in the fight against the war product.

This as a classic example of what Uncle Sam produces. A surprisingly few of these ancient tools, on production boards, are still doing valuable service in spite of the requirements of modern war.

Moreover, certain lathes and other machine tools that turned out parts for the engine of the Civil war vessel, nearly a century ago, also are enlisted for the duration of the present conflict.

Other Civil war veterans include a steam hammer in Milwaukee, which shop men have to use along to keep it from rusting. In Pa., that was built by the Allen Works, produced parts for the Monitor in the last year of the war.

At Lynn, Mass., that was the Columbian Works, which built the Monitor's gun, also is producing parts for the new war.

Machine Tools, regardless of age are doing their bit producing for "all-out" War. LIMA GEARSHIFT DRIVES adaptable to all types of machine tools, simplify machine operation, increase operator efficiency and eliminate time waste, so vitally essential today. Lima Drives will step-up your production ... write us today.

PROMPT DELIVERIES

FOUR TYPES TO CHOOSE FROM

TYPE F1 - DIRECT DRIVEN UNITS, 1 to 5 H.P.

TYPE F2 - DIRECT DRIVEN UNITS, 7 1/2 to 25 H.P.

TYPE F1D - BELT DRIVEN UNITS, 1 to 5 H.P.

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THE LIMA ELECTRIC MOTOR CO.

LIMA, O. OFFICES: NEW YORK · CHICAGO · DETROIT U. S. A.

LIMA ELECTRIC MOTORS · LIMA MAGNETIC POLISHING LATHES · LIMA GEARSHIFT DRIVES

Ten Things About Milling That Every One Knows

(BUT SOMETIMES FORGETS!)

1—Set the work up right the first time. Utmost rigidity is absolutely essential. Use shims or jacks where necessary to keep the work from springing under the cutter.

2—Don't clamp directly onto polished surfaces. Insert something between. Otherwise it may be necessary to scrap the job after it is taken down!

3—Use correct wrenches. Wrenches too large round the corners of nuts and induce slipping. Serious accidents result from slipping wrenches!

4—Clean arbor shanks and spindle interiors. Have the surfaces free from grease and dry, to prevent slipping of arbor in spindle. Trouble usually follows a dirty fit!

5—Be sure of the "hand" of the cutter. Left hand cutters, hurriedly set up for a right hand job, may be badly damaged before the machine can be stopped..

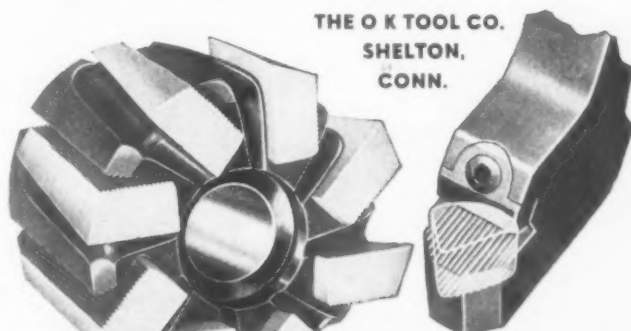
6—Speed and feed *must* be right. This means the co-ordination of numerous variables. A heavy cut at low speed may not be as effective as a light cut at a fast speed. Watch cutter speeds, also. Running a cutter too fast dulls it, wastes power, leaves a poor finish. If in doubt check over your data again or consult your chief.

7—To maintain precision, keep tools sharp.

8—Check for errors first, not after the work is started. One error passed may ruin valuable stock, waste hours of precious time.

9—Have everything at hand before starting the machine.

10—Last, but not least, don't force a cutter into the work when it is evident from the sound that something is wrong!



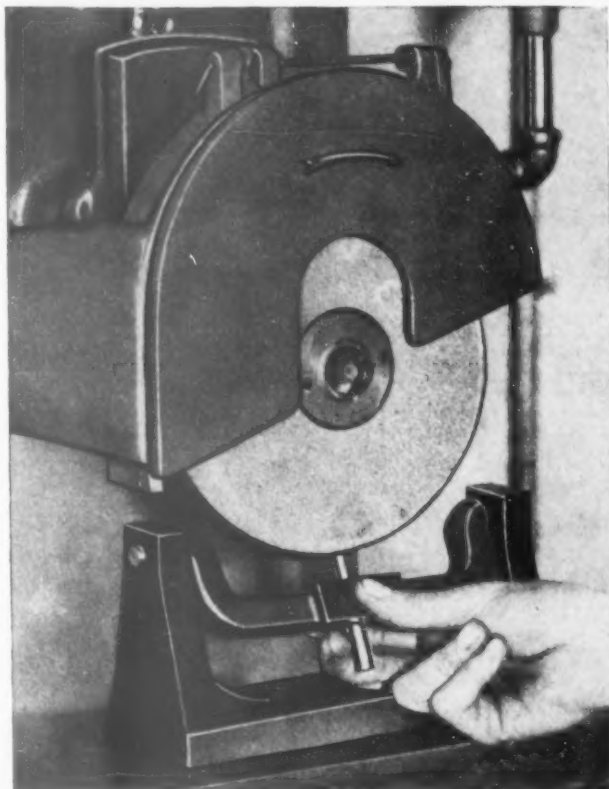
THE O K TOOL CO.
SHELTON,
CONN.



SYSTEM
OF INSERTED-BLADE METAL CUTTING TOOLS

JULY, 1942

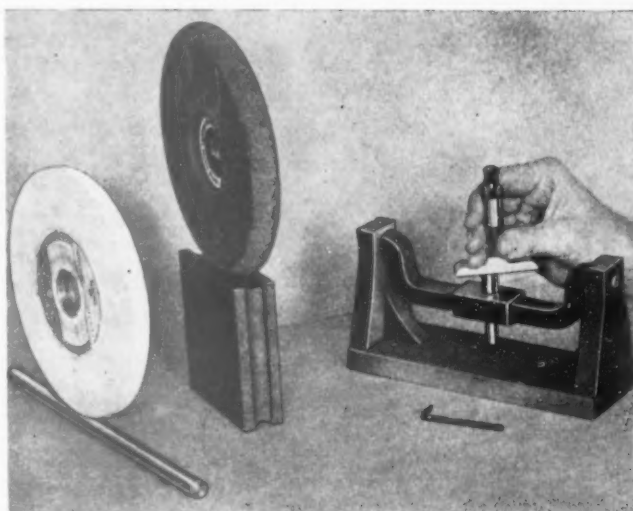
"Little Wonder" Radius Dresser Saves Time in Every Grinding Room



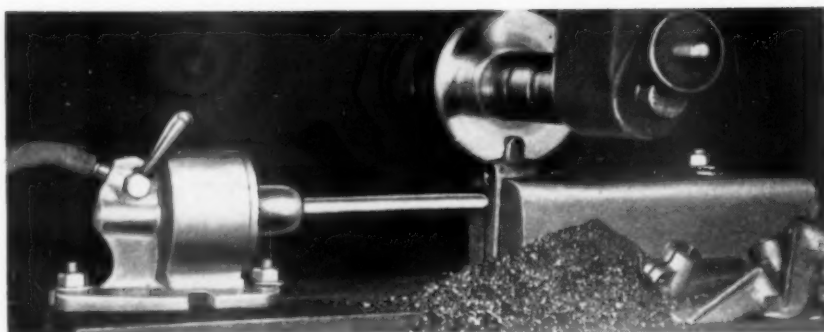
The "Little Wonder" Radius Dresser will dress radii from 0 to 1" quickly and conveniently. This is a time-saving device for every grinding room. May be simply and accurately set by micrometers or gage blocks. It does not contain bearings which may become clogged with emery. It will dress either convex or concave radii and is free from chatter.

Price, Radius Dresser Only \$39.50
Natural Pointed Coldset Diamond 1/3 carat \$6.50

PLACE YOUR ORDER NOW SUBJECT TO APPROVAL AND ACTUAL TRIAL IN YOUR SHOP. WRITE, WIRE, or TELEPHONE CANAL 6-1464 FOR PROMPT SERVICE.



George Scherr Co., Inc. 132 Lafayette St.
New York, N. Y.



Mead Air Clamp
Designed for use on T-slotted tables.

64 FEED AND CUTTING CHANGES



Send for free bulletin that gives full details and specifications on this production-minded lathe.

The quick change box is a one piece casting constructed to preclude the entrance of chips and dirt and houses the mechanism for feed and thread cutting changes. There are 64 changes including $11\frac{1}{2}$ threads, covering a wide range without the necessity of extra pick-off gears. Simple and easy to operate, changes can be made instantly. The gears are alloy steel with accurately cut teeth. All the sliding gears have pointed teeth and are mounted on splined shafts to facilitate easy engagement. Just the lathe for your War Shop!

BRADFORD



Metalmaster

LATHE

ALSO MANUFACTURERS OF DRILLING AND TAPPING EQUIPMENT

THE BRADFORD MACHINE TOOL CO.

CINCINNATI, OHIO

PRECISION TOOLS SINCE 1840

NEW EQUIPMENT

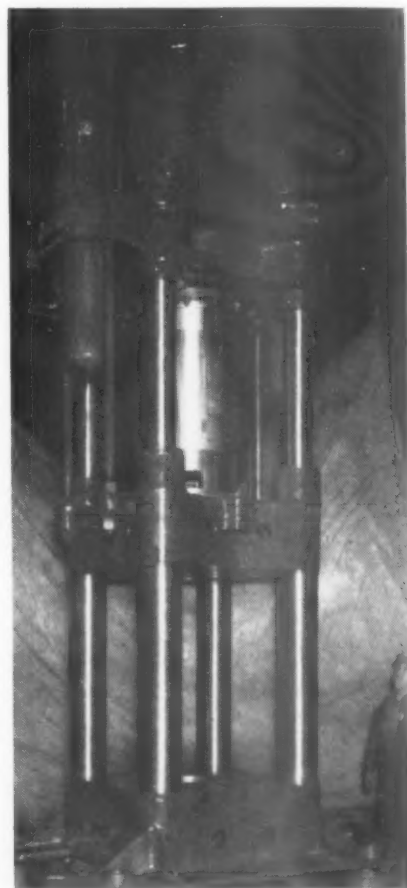
had that delivers a vertical thrust. This one is designed for use with a walking beam or lever pivoted on a separate fixture located between the ram and the work.

500-TON PIERCING PRESS

(H12)

The main ram of this new 500-ton piercing press, made by the Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia, has diameter of 32 inches and a stroke of 42 inches. Produced for shell forging plants, this press has a working pressure of 1,500 pounds.

The distance between the platens is 99 inches and the stripper cylinder in the bottom platen has a diameter of 12 inches. Complete with operating valves and piping, this press is of all cast steel construction.



Baldwin Southwark Press
Main ram diameter 32 inches.

All rams are of hard cast iron and all cylinder guides and column guides are bronze bushed. Press columns are said to be especially sturdy to withstand the heavy service of 240 strokes per hour on a 24-hour day operation.

THE TOOL ENGINEER

**BRAEBURN ALLOY
STEEL CORPORATION**
(Pittsburgh District)
BRAEBURN, PA.

VIBRO

**CHROME
TUNGSTEN
SHOCK STEEL**

Chemical Analysis

Carbon
.50

Chromium
1.40

Vanadium
.25

Tungsten
1.9

Heating Instructions

Forging

Annealing

Hardening

Draw

(Brinell 196-217)

1750° F 1900° F

1450° F

1700° F 1750° F

350° F 600° F

Hardness Data

Draw	1750° F (Oil)
As Quenched	C-58
400° F	C-56
500° F	C-55
600° F	C-54
700° F	C-53
900° F	C-50
1000° F	C-47

Applications

HOT WORK

Shear Knives
Flying Shears
Hot Cutters
Forging Dies
Swaging Dies
Dummy Blocks

COLD WORK

Pneumatic Tools
Battering Tools
Rivet Busters
Chisels-Punches
Pipe Cutters
Shear Knives

Write for Literature

BRAEBURN ALLOY STEEL CORP.

BRAEBURN, PA.

CAD Standardized Set-up Appliances

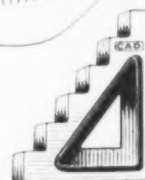
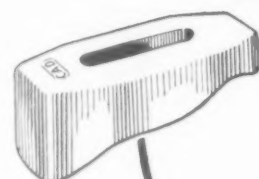
SPEED UP WAR PRODUCTION IN MACHINE SHOPS

CAD Standardized appliances expedite machine tool set-ups—cut non-productive time to the bone. CAD Bolts fit T-slots when ordinary bolts are ruinous. CAD Bolts, clamps, jacks, step-up blocks, wedges, spacers make the set-up job a snap—they save time and money every day.

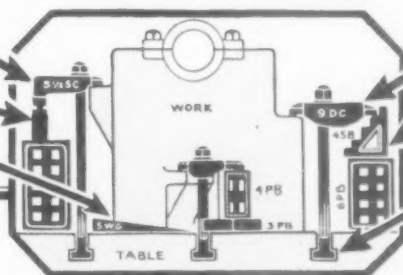
CARRIED IN STOCK

AKRON, Ohio, Hardware & Supply Co.; BOSTON, Mass., Chase Parker & Co., Chandler & Farquhar; BRIDGEPORT, Conn., Hunter & Havens; BUFFALO, N. Y., Beals, McCarthy & Rogers; CHICAGO, Ill., Hibbard, Spencer & Bartlett Co., Samuel Harris & Co.; CINCINNATI, Ohio, E. A. Kinsey Co.; CLEVELAND, Ohio, Cleveland Tool & Supply Co.; DALLAS, Texas, Briggs-Weaver Machinery Co.; DETROIT, Mich., Chas. A. Strelinger Co.; HOLYOKE, Mass., J. Russell & Co.; INDIANAPOLIS, Ind., Vonnegut Hdw. Co.; LOS ANGELES, Calif., Almquist Bros. & Viets; MILWAUKEE, Wis., Western Iron Stores Co.; Harry C. Kettleson, Inc.; MUSKEGON, Mich., Muskegon Hdw. & Supply Co.; NEWARK, N. J., Squier Schilling & Skiff; NEW YORK, N. Y., Neal & Brinker, Manning Maxwell & Moore; PHILADELPHIA, Pa., Maddock & Co.; PITTSBURGH, Pa., Somers, Fittler & Todd Co.; PORTLAND, Ore., General Tool Co.; SAN FRANCISCO, Calif., C. W. Marwedel; SEATTLE, Wash., C. M. Lovested & Co.; ST. LOUIS, Mo., Colcord-Wright Mch. & Sup. Co.; SYRACUSE, N. Y., Syracuse Supply Co.; TOLEDO, Ohio, Bostwick-Braun Co.; TORONTO, Canada, Canadian Fairbanks Morse Co.

WRITE TODAY FOR BULLETIN A-70



CAD
Standardized
set-up appliances



STANDARD SHOP EQUIPMENT CO.
Set-up appliances for machine tools
8176 TINICUM AVE., PHILADELPHIA, PA.

SHELL BANDING MACHINE

(H13)

Having a capacity for 20 to 75 mm. armor-piercing or high-explosive shells, this new shell banding machine, made by the Rehnberg-Jacobson Manufacturing Company, Rockford, Ill., can be arranged to exert one to four squeezing actions.

Pressure is adjustable to suit given operating conditions. The operating time per stroke is 1½ seconds. The drive is by a 10 hp motor and a change-

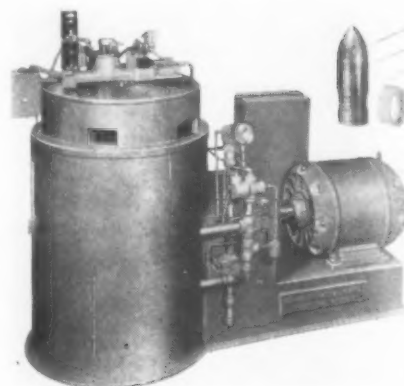
over from one shell size to another can be made in about 15 minutes.

HYDRO-WHIRL MAGNESIUM BOOTH

(H14)

Claiming an increase in the safety factor, Industrial Sheet Metal Works, Detroit, manufacturers of this booth, are now making the bench-high grating of the compartment where the work is done out of hardwood instead of steel.

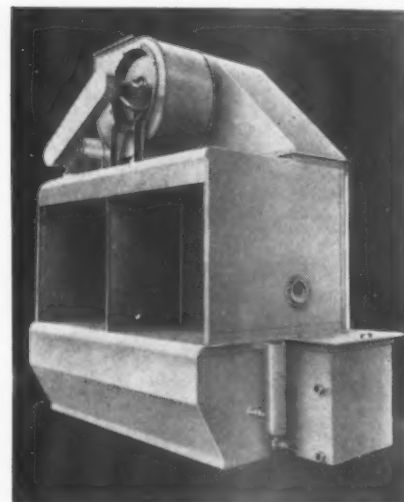
This will not produce sparks if struck with a grinding wheel or tool and thus



Shell Banding Machine
Pressure is adjustable.

the possibility of having sparks ignite the magnesium dust created by the grinding, buffing, or polishing operations performed within the booth is said to be removed.

An automatic control maintains the water level at a uniform height in the tank below the grating, not allowing it to run dry to endanger the safety of the operator.



Hydro-Whirl Magnesium Booth
Automatic control for water level.

SKILSAW TOOLS

HELP WAR-BUSY HANDS GET MORE DONE

faster!

EVERY MINUTE COUNTS

● America wants more speed in production...and fast SKILSAW TOOLS give every hand more productive power. America wants fewer work interruptions...and dependable SKILSAW TOOLS keep every hand on the job. It's no accident that SKILSAW TOOLS are at the front in the battle of production—America's busiest war-work plants use them to cut days from schedules, to pack more vital work into every hour that brings us closer to Victory!

If you have problems of production speed (and who hasn't?) ask your distributor to show you, in your own plant, on your own work, how SKILSAW TOOLS can help you.

SKILSAW, INC.
5051 Elston Avenue, Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Seattle • Toronto, Canada

ABOUT DELIVERIES

Your distributor can deliver most SKILSAW TOOLS from stock or ship promptly from factory...for all war-production needs

• SKILSAW DRILLS—25 Models. For fastest production drilling. Capable from ¼ in. to 1½ in. in steel.

• SKILSAW DISC SANDERS—5 Models. Grind, file, sand and polish on all flat or curved surfaces.

• SKILSAWS—3 Models. Cut masonry and concrete in production and war plant construction.

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

C CLAMP

(H15)

Available immediately in the 1¼ inch size and manufactured to order in other sizes is a new high strength C clamp announced by the Products Engineering Company, Los Angeles, Cal.

Having a breaking point of 7800 pounds, this clamp is manufactured by a drop-forged process and all parts are heat-treated. The screw is of the square head type.

HEAVY DUTY VISE

(H16)

Extra clearance for full freedom when

**FOR QUICK
DELIVERY!**



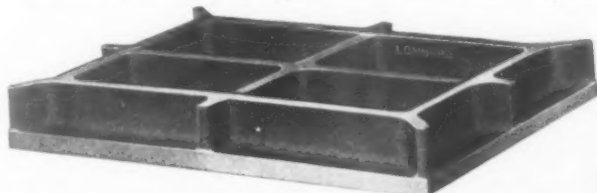
ACCURATE BENCH PLATES

RUGGED CONSTRUCTION • TRUE SURFACE • FOR PRODUCTION WORK

LOMBARD Bench Plates are made of high grade, close-grained, semi-steel type iron. They are specially heat treated to relieve casting and machining stress and strain, and planed to obtain accurate surface. Every stage of their manufacture is under rigidly supervised control. Rigid, heavy construction insures solidity and maintenance of accuracy under constant use. Top sur-

face is of ample thickness to permit drilling, tapping or other machining where it is desirable to mount tool details on the plate.

The accurate working surfaces of Lombard Bench Plates lend them particularly for use in bench assembly work of small precision pieces, as well as for a wide range of bench inspection and layout operation.



Note heavily ribbed construction, insuring an ever level working surface under mass production work.

Stock size 10 x 14 x 2, approx. wt. 31 lbs.
Inquiries solicited on any size bench plate.

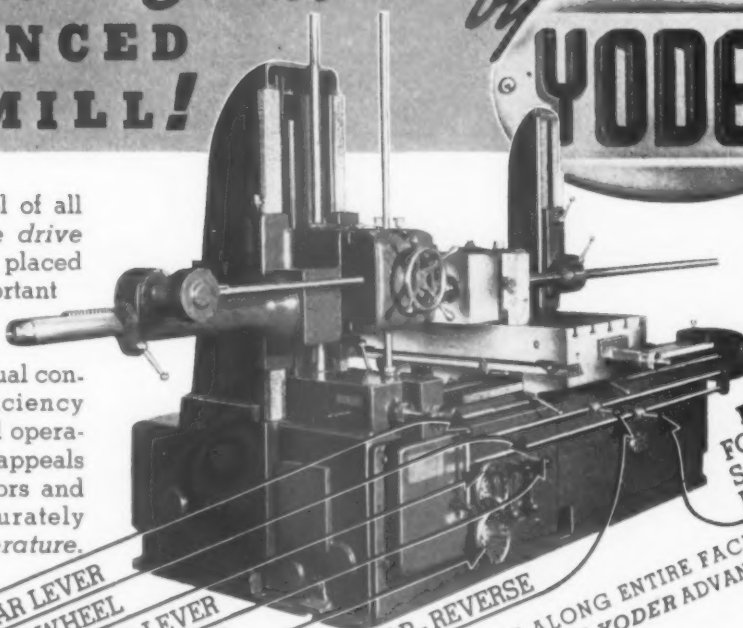
WRITE FOR DETAILS AND PRICES

LOMBARD GOVERNOR CORPORATION
100 MAIN ST. ASHLAND, MASS. U. S. A.

More Efficient Control
**of an ADVANCED
BORING MILL!**

by **YODER**

INSTANT and accurate control of all operations, through a *single drive unit*, is afforded by conveniently placed wheels and levers, the most important of which are slidable and accessible *at any position* along the front of the machine • This unusual control with uncommonly high efficiency and a wide range of speeds and operations, aids beginner mechanics, appeals strongly to experienced operators and assures a large output of accurately machined parts • Write for literature.



RAPID TRAVERSE
FEED—BACK-GEAR LEVER
FEED—CHANGE WHEEL
SPEED—BACK-GEAR LEVER
SPEED—CHANGE WHEEL
SPINDLE—FORWARD-STOP-REVERSE

**FEED
FORWARD
STOP
REVERSE**
(LEVERS SLIDABLE ALONG ENTIRE FACE OF MACHINE. AN EXCLUSIVE YODER ADVANTAGE)

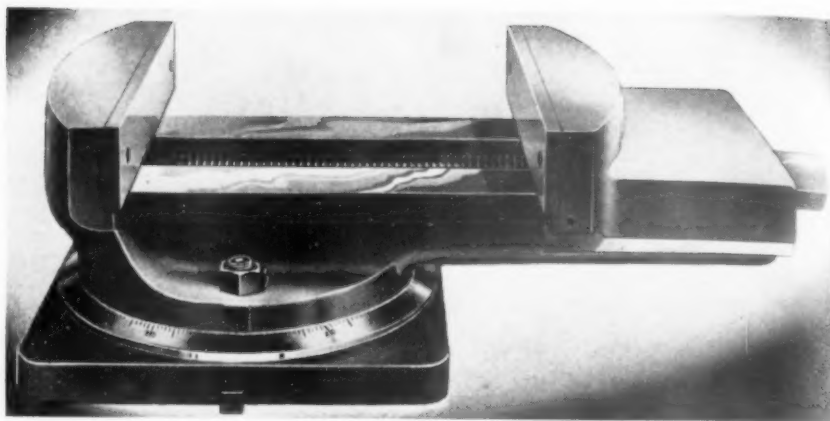
THE YODER SALES CO.

5500 WALWORTH AVENUE
CLEVELAND, OHIO

—NEW EQUIPMENT—

swiveling over the base clamps is one of the features found in a new heavy duty 13 inch precision vise being manufactured by the David J. Ross Company, Benton Harbor, Michigan.

Other features include oversize bearing area on the ways and sliding jaw which is for greater strength and accuracy, complete graduations around the entire jaw for quick removal of chips and waste from around the screw, and the hardened and ground tool and steel jaw plates which will open to full 13 inch capacity.



Ross Heavy Duty Vise
Has 13 inch jaw capacity.



Many Sizes of Super, Standard Carbide Tipped Reamers Are Available from Stock

Many sizes of Super, Standard Carbide Tipped Reamers are available from stock for immediate delivery; other sizes are on hand in semi-finished form ready for completing to required sizes for quick delivery.

Super, Standard Carbide Tipped Reamers applied to your work will help turn out more pieces in less time, reduce the cost of your production, and maintain a higher degree of accuracy.

Inquire now about sizes available ready to go to work on your production and ask for Bulletin R-1 on carbide tipped reamers.

• SOLID TYPE

STRAIGHT SHANK
TAPER SHANK

SUPER TOOL CO.

21640 HOOVER RD.

DETROIT, MICH.



CARBIDE TIPPED TOOLS

FOR TURNING - FACING - REAMING - SPOTFACING - BROACHING
FORMING - GRINDER RESTS - WEAR PARTS - BORING - MILLING - DRILLING
GROOVING - COUNTERBORING - SHAVING - CENTERS - SPECIAL PURPOSES

These vises are already in production and are made in three sizes; 7, 10, and 13 inch jaw capacity.



Hammond Tool Grinder
Features new wheel guard.

CARBIDE TOOL GRINDERS

(H17)

The 10 and 14 inch models of the Hammond carbide tool grinder are now equipped with a new scientifically designed wheel guard it has just been announced by the Hammond Machinery Builders, Inc., 1636 Douglas Avenue, Kalamazoo, Michigan.

The guards are concealed and are close to the wheels and stop spraying and splashing. They act as a coolant flow control and keep the operator and the floor dry during wet grinding operations, it is claimed. Each guard is easily rotated from one side of the wheel to the other by a handle.

Providing a quick means of adjustment for wheel wear and wheel changes, the hood which encloses the guards and the table mechanism are mounted on enclosed shaftways and are moved in or out from the wheel by a crank.

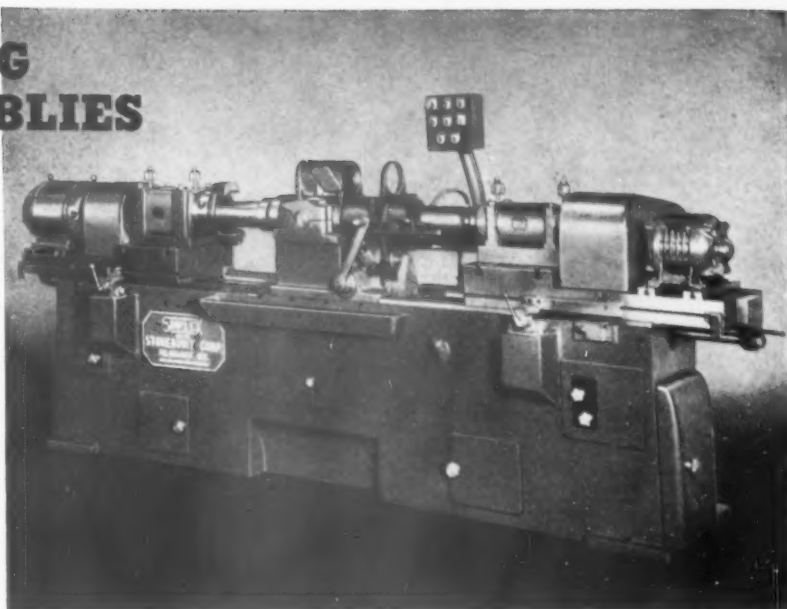
MOTOTRACE

An accessory called the Mototrace and used with the Profilometer for mechanical tracing of surface finish has been announced by the Physicists Research Company, 343 South Main Street, Ann Arbor, Michigan.

PRECISION BORING OF BULKY ASSEMBLIES

The *Simplex* Unit Type Precision Boring Machines, Double End—2 spindle models are readily adapted to the fast, accurate boring of large diameter bearings. The machine shown here is set up to bore sleeves and get the bores exactly in line.

This is one of the many jobs *Simplex* Precision Boring Machines are doing in the Armament Program. Others are precision bearings, motor transport parts of all kinds, directional radio controls, propeller shaft sleeve bearings, etc. *Simplex* Unit Type Precision Boring Machines possess such flexibility of design that they can be built to handle with maximum efficiency a great variety of boring jobs. Let us help you with your precision boring problems.



Simplex Unit Type Precision Boring Machine, Double End, Two Spindles.

Precision Boring for Accuracy at Low Cost

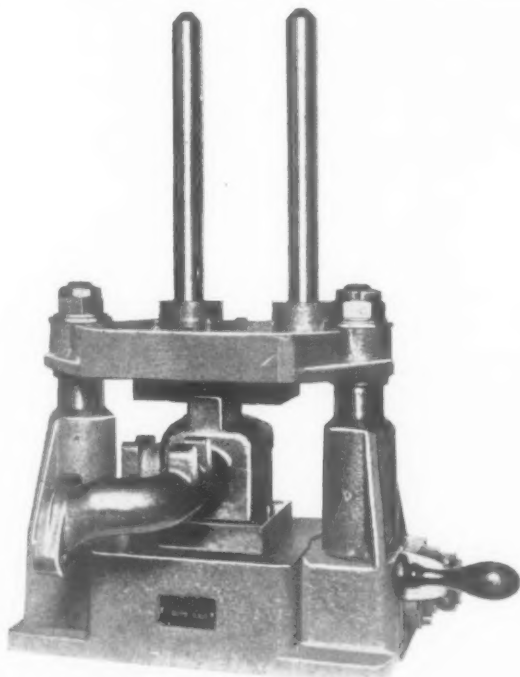
STOKERUNIT CORPORATION

4548 West Mitchell Street

Milwaukee, Wisconsin

S I M P L E X

Precision Boring Machines
Planer Type Millers
Special Machine Tools



13330 Foley Ave.

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Tulsa, Okla.—Brammer Machine
& Tool Service Co., Inc.

TOOLING ECONOMY WITH STANDARD FIXTURES YOU ECONOMIZE IN ENGINEER- ING, CLAMPING TIME, AND RETOOLING COSTS

ASK FOR CATALOG 941

A Swartz standard L L Type fixture is shown equipped with adapters for chucking an intake manifold to drill inlet and two bolt holes in carburetor flange. Guide bars are shown arranged for multiple head.

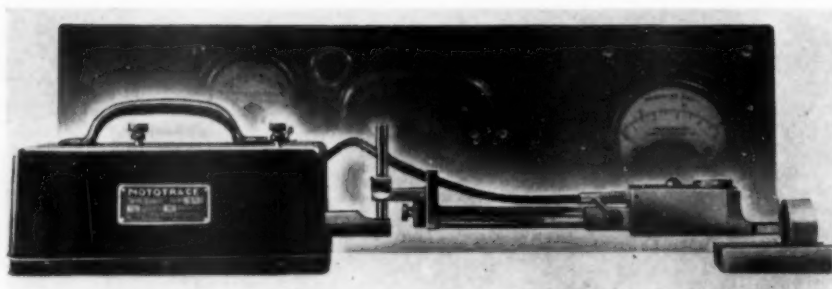
**SWARTZ TOOL
PRODUCTS CO., INC.**

Detroit, Michigan

Represented by

Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.

Oneida, N. Y.—W. F. Himmelsbach
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool
& Equipment Co.

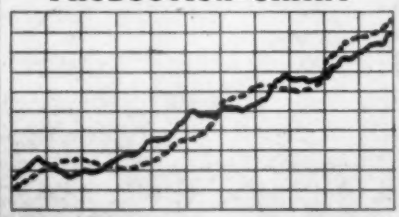


Mototrace for Use With Profilometer
For mechanical tracing of surface finish.



*...make a BIG
difference here*

PRODUCTION CHART



If you can't get all the machine tools you need—try to get more production from those that are now in your shop. Unless you have been using Teco Carbide Tools, it's a safe bet that you are not getting full capacity from your machines.

Teco Carbide Tools are distinctive for their unusual hardness, density and uniformity. They hold their cutting

edges longer; cut at higher speeds; produce more pieces between grinds; maintain accurate tolerances for longer runs. Try Teco Carbide Tools and be convinced. Grades and styles for practically every machining need, available for prompt shipment.

TECO CARBIDE TIPS FOR IMMEDIATE SHIPMENT. Standard grades, styles and sizes.

TUNGSTEN ELECTRIC CORPORATION

570 39th Street Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Pioneers in Tungsten Carbides for Over a Quarter Century



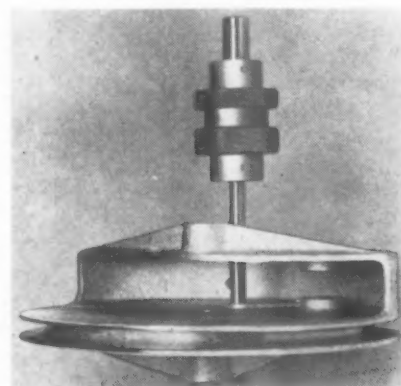
This accessory is said to be especially valuable for securing accurate readings on very fine surfaces. It is also claimed to be useful for measuring softer materials, awkward shapes, distances as short as 1/32 of an inch, and surfaces such as those in small holes, adjacent to shoulders or bosses, and on gear and hob teeth.

BURRING TOOL

(H19)

Said to be particularly effective in removing burrs from the inside edges of multi-walled parts, an entirely new burring tool has just been announced by the Nobur Manufacturing Company, 6156 Santa Monica Boulevard, Hollywood, Cal.

Simple in construction and operation, this burr removing tool is said to cut finishing time to a minimum. Used in a drill press, lathe, or other machine spindle, it is kept in continuous motion while parts are fed to it as fast as the operator can handle them. This tool consists of a cylindrical shaft which pilots in the hole to be de-burred and to one end of this shaft is fastened knurled collar. By sliding the collar up and down, the burring blade may be advanced into the cutting position or withdrawn.



Nobur Burring Tool
Used in machine spindles.

MILLING HOBS

(H20)

Said to eliminate any discrepancy between thread form and form of finished work, a multiple thread milling hob designed to speed up production is being manufactured by the U. S. Machine Tool Manufacturing Corporation, Terre Haute, Indiana.

These milling hobs are manufactured for any thread system, for any thread angle, for any thread form, for inch or metric scale, and for left or right hand threads. They are made up to 7 inches

THE TOOL ENGINEER

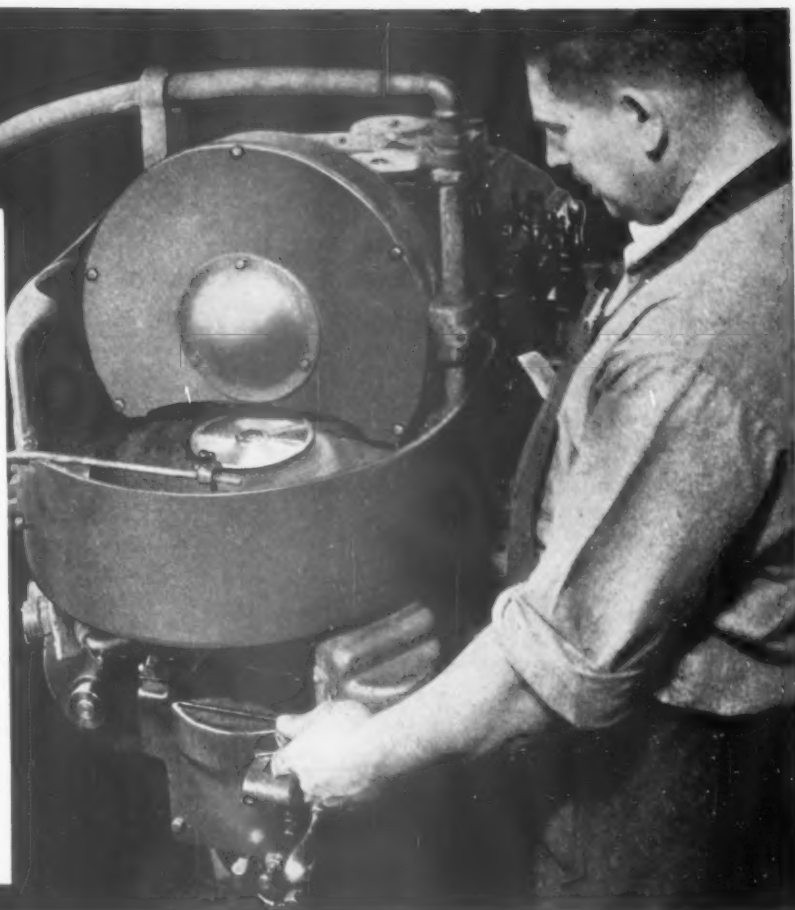


Hyde Manufacturing Company, Southbridge, Mass., for more than half a century manufacturers of quality cutting tools depends on **ARTER SURFACE GRINDERS** for fast, accurate production.

This operation: grinding Hyde circular blades for cloth, leather, rubber, etc. Both flats and bevels, in step with today's war-plus production requirements.

Arter engineering for increased precision surface grinding is at your service.

ARTER GRINDING MACHINE CO.
Worcester, Massachusetts, U. S. A.



MAC-IT

QUALITY STEEL SCREWS

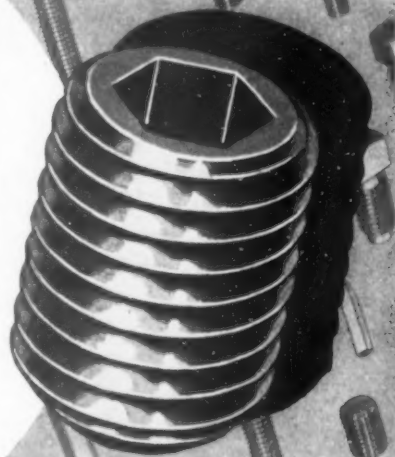
Mac-it hollow set screws stand severe usage without rounding or splitting the socket because:

1. Mac-it **cuts** each angle of the hexagon socket to insure positive key engagement from top to bottom.
2. Mac-it heat treatment multiplies strength and increases durability.

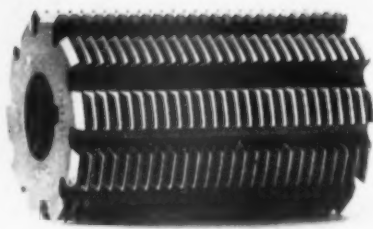
That's why Mac-its stand up supremely well in service!

OTHER MAC-IT PRODUCTS INCLUDE:

Socket Head Cap Screws • Hexagon Head Cap Screws
Square Head Set Screws • Stripper Bolts
Hexagon Socket Pipe Plugs



THE STRONG CARLISLE & HAMMOND CO., Cleveland, Ohio



Thread Milling Hob
Manufactured for any thread system.

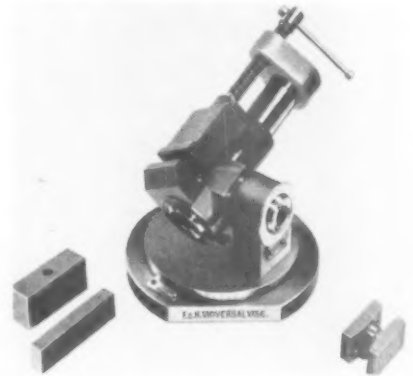
O. D. and 4 inch thread length for internal or external threading.

UNIVERSAL VISE (H21)

Described as an "angle machining package" and designed to reduce set-up time in the production of compound angles, a vise with attachments has just been announced by the F & H Manufacturing Company, 6024 Ellery Street, Detroit.

The "package" consists of three

parts: the F & H universal vise with improved locking control, a grinding wheel angle dressing attachment, and an unique swivel clamp for holding odd shaped work pieces.



F & H Universal Vise
Designed for angle machining.

This clamp consists of two friction plates joined together by ball and socket. It fits between the work piece and one jaw of the vise, and, being fastened to the latter, adapts itself to the angle of the piece.

This vise is of all steel construction, has vernier dials as standard equipment, and has a jaw opening of 2 1/4 inches.

ENDLESS BELT SANDER (H22)

Large, flat as well as concave or convex surfaces on wood or metal are said to be finished with lightning speed with this endless belt sander announced by the Jefferson Machine Tool Company, Cincinnati, Ohio.

The table travels on ball-bearing rollers. The belt travels at just the right level to enable the operator to work in a natural position without fatigue. There is no cross rail between the standards to obstruct the operator's vision.

The vertical adjustment of the table (ten inches) provides for work of great thickness. The belt standards may be set as far apart as desired to accommodate long surfaces. An auxiliary work table may be used or the table stand may be entirely moved to one side for special work.

CHAIN-TYPE CONVEYOR (H23)

A new conveyor, consisting of a steel tubular track in which is a continuous chain made up of a series of vertical and horizontal wheel units, was recently introduced by the Richards-Wilcox Manufacturing Company of Aurora, Illinois.

The vertical wheels of the conveyor are connected by an axle through the side plates of the unit frame. The hori-

Is Excess **DOWN** *Time*

Retarding Your Production?

KENNAMETAL WILL GIVE YOU LONGER Tool Life BETWEEN GRINDS

KENNAMETAL is the most durable of all steel-cutting carbide tool materials. It removes 3 to 10 times more metal between regrinds, as compared to high speed steels, and thus greatly reduces "down time" for re-sharpening and re-setting tools. The longer tool life of KENNAMETAL also enables users to operate with smaller tool inventories, reducing tool investment and increasing the nation's backlog of these vital cutting tools.

On all types of jobs . . . on steels hardened to as high as 550 Brinell, KENNAMETAL is turning "down time" into production time . . . getting the work out faster and better. Find out what it can do for you.



Write today for the new KENNAMETAL
Vest Pocket Manual.

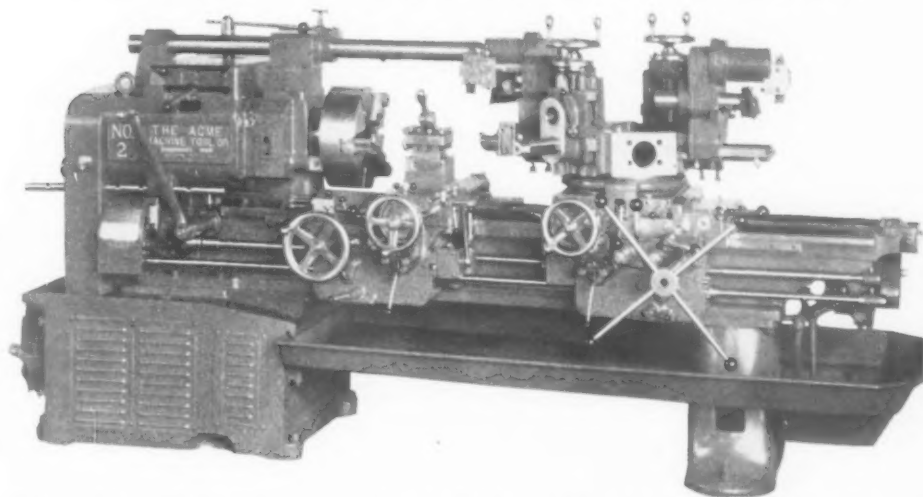
KENNAMETAL: INVENTED AND MANUFACTURED IN U. S. A.

McKENNA METALS Co.

400 LLOYD AVE., LATROBE, PENNA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

RIGIDITY and ACCURACY UNDER HEAVIER CUTS AT FASTER SPEEDS!



No. 2 Universal Turret Lathe with stationary overhead pilot bar and headstock brackets. Heavy duty multiple turning heads and vertical side tools and heavy duty reversible cutter holders. Also shown is the lead screw type chasing attachment with split nut brackets and threading dials on both carriages.

This machine with its stationary overhead pilot bar and headstock brackets together with rigid turret tooling permits heavy multiple cuts. Thus accuracy is assured, while faster speeds are possible through the use of cemented carbide cutting tools.

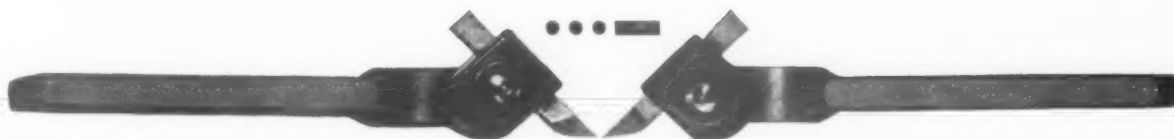
WRITE FOR COMPLETE DETAILS

THE ACME MACHINE TOOL COMPANY
CINCINNATI, OHIO

AMERICAN TOOL HOLDER

REDUCES TOOL BIT BREAKAGE
SAVES TRIPS TO THE TOOL CRIB

NO TOOL WASTE
NO HEATING UP



THE American Tool Holder holds, *with a wide, immovable grip*, all square or round tool bits and boring bars within its capacity—*without the use of spare parts*. This superior holding device will not break high speed steel or cemented carbide bits—short bits are held as solidly as long bits. **Each holder will hold three sizes of bits in four positions.** The tool requires less clearance grinding in an American Holder, because the shank is parallel to the tool.

Mail the coupon for complete details on the four standard sizes.

Please send complete information on the four standard sizes of American Tool Holders.

NAME TITLE
COMPANY
STREET
CITY STATE T.E.

EDWARD BLAKE COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

J-B TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS

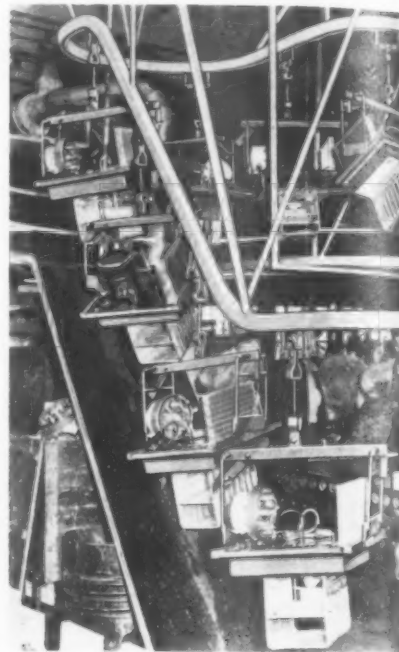
zontal unit is made of a wheel and link, the wheel bearing on the inside of the track when rolling around a horizontal curve. These two sets of wheels keep the chain assembly in the centerline of the track, the vertical wheel units carrying the load, riding the bottom of the track on horizontal runs, rolling under the top of the track on vertical curves, and turning upward or straightening out from downward to horizontal movement.

DUST COLLECTOR

(H24)

A dust collector, said to be particularly suited for use with grinding and polishing machines where no central dust collecting system is available, is announced by the Edward Blake Company, 634 Commonwealth Avenue, Newton Centre, Mass.

In order that all the bearings are protected from dust and grit, the motor and fan are located behind an inexpensive,



Richards-Wilcox Conveyor
Tubular track contains wheel units.

Spring Retainer Shaft

IT'S MADE OUT OF
SPEED CASE STEEL
A LOW CARBON OPEN HEARTH PRODUCT

—because . . .

It saved \$37.50 per ton of steel used
It machined faster than SAE 1112
It increased tool life 45%
It riveted without fracture

Speed Case will rivet • Bend cold 180° 1" Rd. C. D.
Machines at 230 SFPM • Very smooth finish
Excellent carburizing

In this "all-out" war effort Monarch Steel is co-operating 100%.
We're helping to "keep 'em rolling" with Speed Case Steel.



Ductility
Plus
Machinability
(230 SFPM)

Licensors
MONARCH STEEL COMPANY
HAMMOND • INDIANAPOLIS • CHICAGO
PECKOVER'S LTD., Toronto, Canadian Distributor

Licensor for Eastern States
THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO

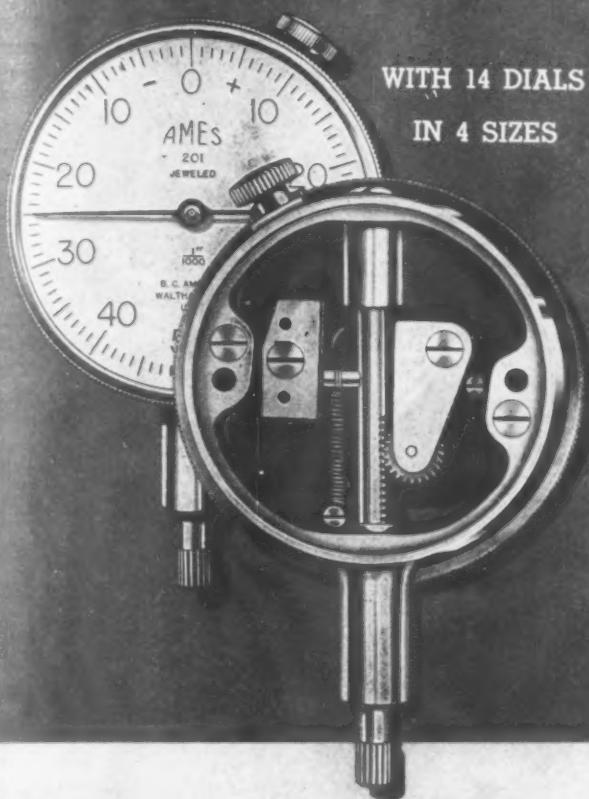
MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS



Edward Blake Dust Collector
Has replaceable filter.

replaceable Dustop filter. This filter is made from fireproof spun glass and it is large enough so that, in certain cases, it may be inverted and the other half used when the first half becomes filled. This dust collector is portable from one machine to another.

AMES *Hundred Series* DIAL INDICATORS



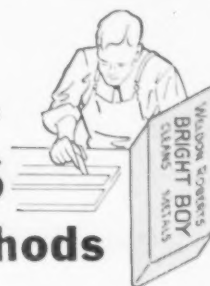
A COMPLETE NEW SERIES

These Dial Indicators have all the desirable features for measuring and checking accuracy. Four sizes to American Gage Design Committee specifications. Fourteen different dial numberings. One-piece, drop-forged cases and stems. Wire attached bezels. Cup-shaped dials that need no springs beneath. Pinions and staffs of hardened steel, ground for accurate fitting and long wear. Various styles of backs and contact points. The best and most effective shock-absorbing wheel assembly, optional.

SEND FOR CATALOG NO. 52

B. C. AMES CO.
WALTHAM, MASS.

Solves UNUSUAL PROBLEMS By Usual Methods



Gives Faster,
Smoother, Better
Work in
**FINISHING
DE-BURRING
POLISHING**



Removes Light
Digs, Tool and
Heat Marks;
Cleans Welded and Soldered Joints; Finishes
Dies; De-burrs Light Stampings and Machined
Parts

WELDON ROBERTS

Brightboy

The Rubber-Cushioned Abrasive

1. NO TIME TAKING CHANGE IN WORK METHODS

Brightboy wheels, for use on lathes and portable and stationary power machines, and Brightboy tablets, sticks, rods and special shapes for hand work, are easily used in the conventional manner. But from a "results" standpoint, there's no comparison! Brightboy's abrasive, "cushioned" right into a resilient rubber binder, gives an unusual operating ease, producing an effect entirely different from a grind or a buff. Gives a faster, smoother, better job. Cuts down operations. The wheels de-burr, finish and put on a slight radius, in one operation!

2. NO SPECIAL TRAINING NECESSARY

Any worker can use Brightboy, without special instruction.

3. NO SPECIAL PREPARATION REQUIRED

Brightboy is ready for immediate use. In operation, the abrasive recedes into the resilient rubber, falling free as the soft rubber binder wears away.

4. NO WASTE

Every bit usable — even a worn-down Brightboy Wheel can be used for manual operations.

Available to war industries through leading distributors. Write us for catalogs and prices if your dealer cannot supply you. Our representative will be glad to call.

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO., Newark, N. J.



WELDON ROBERTS
Brightboy
REG. U.S. PAT. OFF.

Handy Andy Says—



IN my country style account of the St. Louis meeting, a while back, I surmised that Otto Winter would go down in A.S.T.E. history as the Great Coordinator. That was before he'd even started to function as Prex, and what

I'd like to know, now, is this: Am I gifted with a flair for prophecy, or with a native insight into human nature? Or, did Otto just decide to live up to a name? No matter; he's already in his stride and heading straight for the goal set up, the rest of the Exec. Com'tee with him to a man.

There's one thing I get a kick out of, though: — the gang from the southern fringes, which included Rip Collins of Texas, Deacon Sprott of Tennessee and Art Denis and Jack Marvin of California, that held Otto and yrs. truly in durance pleasant at St. Louis, have all been put to work, either on national or

local committees. They just talked themselves into a job, and you know, I think they'll deliver. Incidentally, I had a letter from Rip, who tells me that the Houston gang is getting along right smart. Okay, Rip, and tell your local editorial man to get your Chapter news in, too—right smart!



There's one thing I'd like to put over, in my capacity as Nat'l. Editorial Ch'man, although it's an awful job to break some of you boys of fixed habits. We want, for every issue, not only news of the previous meeting but notice of the next session as well. We want it by the 15th., if humanly possible, but not later than the 20th if the meeting comes too close to the earlier date.

The news is still being sent to Irwin Holland, in Hartford, who must then relay it to Detroit. Now, Irwin is busy, like the rest of us, besides which he resigned the editorial headache and is now on Const'n & By-Laws besides which, again, he has to put in a lick of work for Pratt & Whitney same as I have to do for Midland Steel. So now, you editorial men, please mail your news to The Bramson Publishing Co. — or THE TOOL ENGINEER — 2842 West Grand Blvd., Detroit. Please, now!—help save time for busy men.



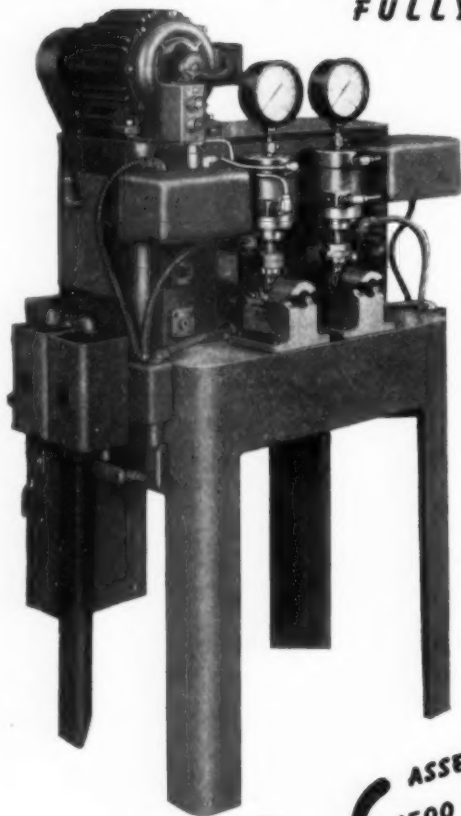
Montreal, for one, came in late last issue, and y'know, I'd go a long way for Montreal, having sort of adopted the Canucks since our meeting at Toronto. They're swell guys. Ad Potter, our Exec. Secy., was telling me that he was up in the Dominion May 7th, to attend the Hamilton Chapter meeting. Actually, however, it was held in St. Catharines, which meant a 70 mile round trip for the Hamiltonians. But that's not the half of it. Some of the boys came all the way from London, Ont., totaling some 230 miles which means something in these days of gas rationing. Yessir, men, those boys in the wide, wide spaces up North take their Tool Engineering seriously. Hail Canada!

San Diego, Cal., has broken with precedent in solving meeting problems. With plenty of men busy, they've decided to hold the regular meetings every other month, with the intervening meeting held during the forenoon of the last Sunday of the alternate month. This arrangement gives the boys a chance to attend at least one meeting a month, a plan that could well be emulated in these hectic times. We've a great gospel to spread, one that will live when this orgy of destruction is over.

Meanwhile, the Springfield, Mass., boys are hard at work getting ready for the Semi-Annual in October. This meeting, significantly, is to be known as the

SOLDER TESTING MACHINE FOR 37 MM. A. P. SHOT ASSEMBLIES

**FULLY AUTOMATIC CYCLE
CHECKS SOLDER
JOINTS QUICKLY
AND ACCURATELY**



When a shot-and-cap assembly is placed in the fixture, it trips a switch which starts the automatic cycle. A hydraulically-operated ram descends against the cap. Pressure is relieved at 1500 lbs. and the ram returns to starting position. The machine shown has two independent units, each complete with hydraulic circuit, relief valve, and cycle controls. A 1 h.p. motor drives the common hydraulic pump. Time of one cycle is approximately $2\frac{1}{2}$ seconds and average production is 800 to 900 pieces per hour.

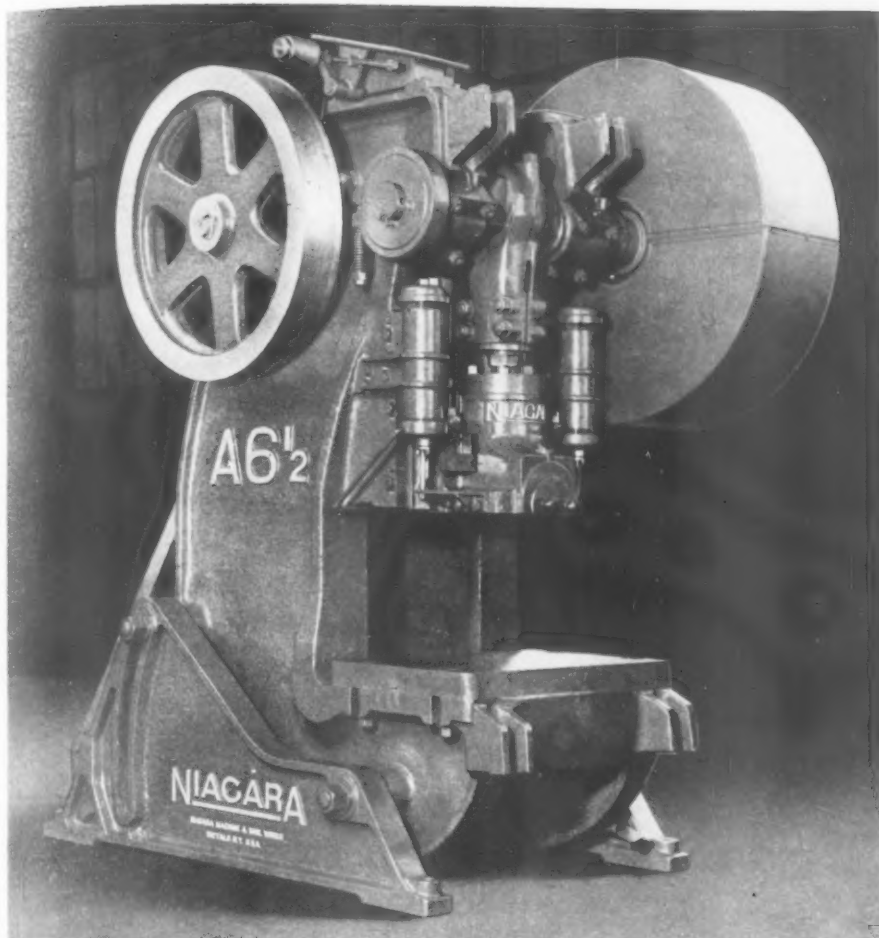


We specialize in the design and manufacture of distinctive production machinery and are seeking opportunities to help you obtain greater production at lower unit cost.

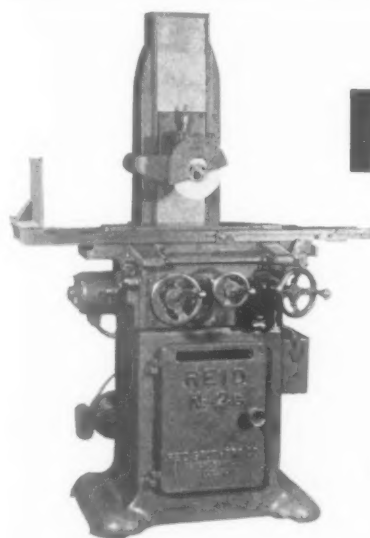
The cap is assembled to the shot with a wiped solder joint. To meet specifications, this joint must withstand a lateral pressure of 1500 lbs. applied against the threaded portion of the cap.



RENNBERG-JACOBSON MFG. CO.
Special Machinery
2137 KISHWAUKEE ST. • ROCKFORD, ILLINOIS



The big bomber program and the production of ordnance materiel are being speeded up by the use of Niagara open back inclinable presses. The No. A-6½ press shown above is one of the complete Niagara line built in capacities from 7 to 190 tons. Specifications are given in Bulletin 58 available upon request. Niagara Machine & Tool Works, 637-97 Northland Ave., Buffalo, N. Y. Branches: Cleveland, Detroit, and New York.



THE REID

2B
All Electric
Automatic
and Hand
Feed Surface
Grinder

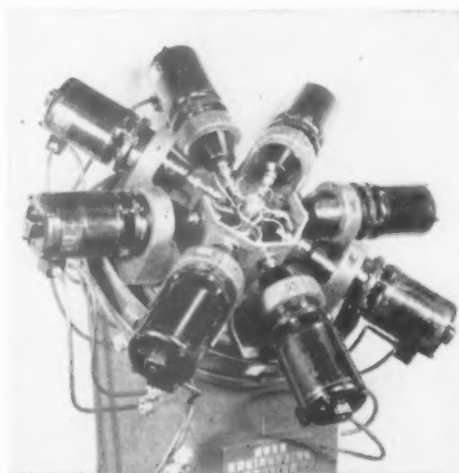
THE Reid All Electric Surface Grinder is equipped with a motorized spindle, thereby eliminating all belts, pulleys, and counterweights. Table and cross slide are equipped with oil rollers, insuring greater life and proper lubrication. Table is operated with a silent chain instead of rack and pinion gears. Grinding capacity 6 x 18 x 11. Additional height if required on all standard machines. Send to Dept. O for descriptive literature.

Exclusive Sales Agents

H. LEACH MACHINERY CO.

387 Charles St., Providence, R. I.
A Reid Distributor in Every Principal City

JULY, 1942



V
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**MULTI-UNIT
PRODUCTION MACHINES**
INCORPORATING THE
GOVRO-NELSON
CENTRIFUGAL FEED
DRILLING UNITS
SUPPLIED WITH MOUNTING FACE
HORIZONTAL, VERTICAL or ANGULAR

SEND DRAWING FOR RECOMMENDATIONS ON
YOUR HOLE PROBLEM

HOLE ENGINEERING SERVICE
5901 FOURTH AVE. DETROIT, MICH.

War Production Conference of the American Society of Tool Engineers, or something along that order. Well, why not? The Tool Engineers are the van leaders in mass production, be it for peace or war, and Springfield happens to be a hub in the planetary system of the Hartford Ordnance District. We may expect a great meeting—in Springfield. (How about that dish of clams?)

Scanning the list of national chairmen, just to see how many auld ac-

quaintance I'd meet — and there were plenty — I noticed where Jim Weaver, past Prex and now of New Chapters, has gone and got himself a commission. He's Col. Weaver now, which makes me wonder if we'll dare give him the glad hand when we meet, the way we used to. But, if the Colonel pleases, it's all to the good.

In this man's war, two fisted, practical men are directing operations instead of the shavetails that, stickling for code, discombobulated production schedules in '18. Whatever criticism one

may direct at the Administration, to its eternal credit be it said that it has put shoe-makers to making shoes. In every department having to do with war production we see men—as Bill Knudson, Jim Weaver, Gene Bouton, Cliff Ives, Floyd Eaton and others—that we either know personally or by reputation, all of which inspires confidence in the industrial set-up. Oh, we're going to win, all right; if not soon then "eventually", as the miller said.

On and off, during the past few years, I've been hearing from youngsters (comparatively speaking) who have come under the spell of my unorthodox teaching but have made the grade in spite of it—or maybe because of it, as some of them insist. Fred Plante, for instance (and you recall that I told you to keep an eye on that lad?) writes me from Hartford, where he got himself a job as Tool Engineer only he didn't say with whom. Anyway, I know he'll make good, being an excellent designer and endowed with ingenuity and the quality of leadership. If some reader runs into him, give him my regards and ask him to send his address.

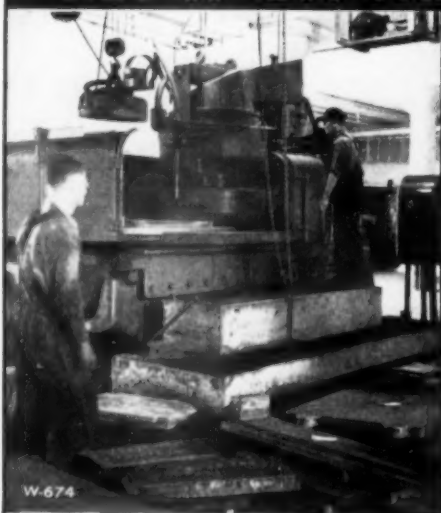
Also heard from Joe Barnett, another of my "boys" for whom I predicted a bright future. Joe is now Supervisor of Processing with Goodyear Aviation, down in Akron—the place where they used to make tires, if you recall. Incidentally, he tells me that the Rubber City boys are going to give the rest of the Chapters a run for the cup, this year, which is fine. But remember, Now!—the slogan for the year is quality. Hold what you have, and knit it the more firmly together.

While rambling around, I might as well tell you something about THE TOOL ENGINEER editorial staff, on which I personally function in the dual capacity of Ed. Ch'man for the Society and as honorary(?) technical adviser for the publication. All that — along with writing this Column which I almost forgot being so close to it — doesn't give me much time for golf which I don't play any more, being content to rest on my laurels. You see, I made a hole-in-one the first time I ever swung a club. All right, all right! You don't have to believe it, but I'll remind you that I won in the Irish sweepstakes a while back, which goes to show that anything can happen — to me.

But to get back to the interrupted story about the editorial staff. Roy (Mr. Bramson when he's on his dignity) has a trio of young fellows (again compar-

(Continued on page 178)

"PUT IT ON THE BLANCHARD"



For speed, accuracy, and low cost on your larger surfaces you should investigate the Blanchard No. 27.

Grind Large Work FROM THE ROUGH

This Blanchard No. 27 Surface Grinder, with 42" segment wheel and 84" swing, grinds steel and semi-steel die shoes from the rough. The work varies in size but each chuck load, whether one large piece or several small pieces, presents a large area from which $\frac{1}{16}$ " to $\frac{1}{4}$ " stock must be removed. Because of the competitive nature of the product (standardized die sets) every effort must be made to keep costs low. Loading time is shortened by using a lifting magnet, and the grinding is done at the fastest possible rate. The machine is kept continuously busy and, in addition to die shoes, it machines many large steel plates.

The BLANCHARD
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.



Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

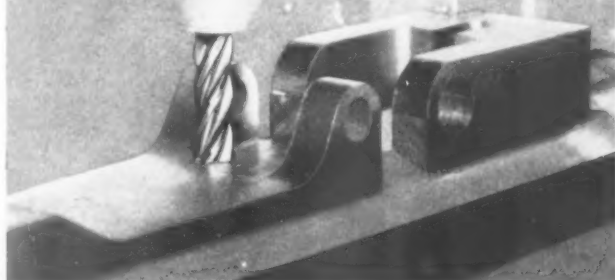
- ★ Production
- ★ Adaptability
- ★ Fixture Saving
- ★ Operation Saving
- ★ Material Saving
- ★ Fine Finish
- ★ Flatness
- ★ Close Limits

★ Especially valuable on jobs like the one illustrated.

END MILLS THAT ARE HELPING *To Speed War Production*

Typical of present-day use of Putnam Hi-Speed End Mills is in the milling of many naval gun parts. On the part illustrated, the inside faces of both the lugs and the adjoining block are finish milled at high speed. The operation is performed on a Milwaukee machine equipped with a follower. The material is high chrome steel.

Putnam End Mills are made for fast cutting and long life. Used in War Production, they make possible a step-up in the speed of many milling operations. They reduce to an absolute minimum machine down-time required for replacement of worn or broken tools.



PUTNAM TOOL COMPANY

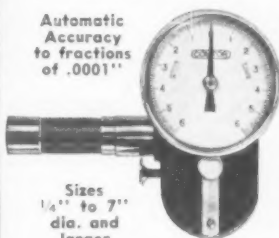
2987 Charlevoix Ave. • Detroit, Michigan

Operators, too need this "5 question" internal gage



Put "inspector-accuracy" AT THE MACHINE with COMTORPLUG

Automatic Accuracy to fractions of .0001"



Sizes 1/4" to 7" dia. and larger

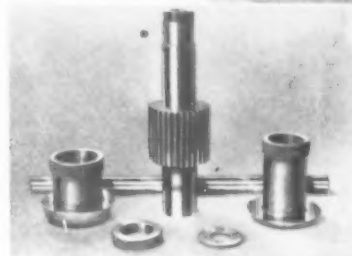
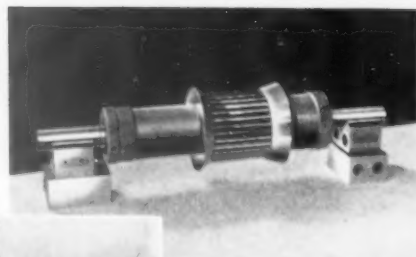
Working to close tolerances, a machine operator can keep rejects to a minimum if he uses Comtorplug to find 1. Actual size of bore; 2. Out-of-round; 3. Front taper; 4. Back taper; 5. Barrel shape or bell mouth. Instant detection of these irregularities permits adjustment of machine BEFORE non-passing work is produced. Just as inspectors need gages better than limit gages, so operators are showing profitable results with Comtorplugs in ordnance, airplane, automotive, electrical and all shops doing close-tolerance work.

Request Bulletin 27

THE COMTOR CO.

70 Rumford Ave.
WALTHAM MASS.

VINCO ACCURACY



To Within **SPLIT TENTHS**

Illustrated is a Vinco spline relation flush pin gage and balancing arbor for an S. A. E. 60 propeller hub. It is shown both in assembly and as individual parts.

This job called for extreme accuracy. Tolerances of every part were held to split tenths. It is typical of the work being turned out regularly by Vinco Corporation.

VINCO
Corporation

9115 SCHAEFER HIGHWAY
DETROIT, MICHIGAN, U.S.A.



Simultaneous Clamping

AT MORE THAN ONE POINT

One clamping operation can now hold several pieces at one time regardless of thickness or shape. A new model Knu-Vise Toggle-Action Clamp (No. KV-195) makes this possible. Its U-shaped toggle arm permits the quick insertion and adjustment—horizontally or vertically—of pressure pads at one or more points. The same setup remains uniformly fixed for entire job. Many motions are thus eliminated, and much time is saved. One flip of lever either clamps or releases. Applied pressure ratio is in excess of 40 to 1.

If you have any clamping operations, perhaps we can show you some shortcuts to save time and speed production.

KNU-VISE
INCORPORATED

2204 Eighth St.
Detroit, Mich.
4328 San Fernando Rd.
Glendale, Calif.

NEW LITERATURE

Of Interest to the Tool Engineer



(437) Cut-Off Blades and Holders

Luers Patented Cut-Off Blades and Holders. 26 pp. Empire Tool Company, 8790 Grinnell Avenue, Detroit. This booklet completely illustrates the various types of holders and blades as applied to specific types of machines. Specifications are given in each case

and the prices of both the holder and the blade are listed.

(438) Shell Gages

Shell Dial Indicator Inspection Gages. 32 pp. Federal Products Corporation, 1144 Eddy Street, Providence, R. I. This folder, approved by the War De-

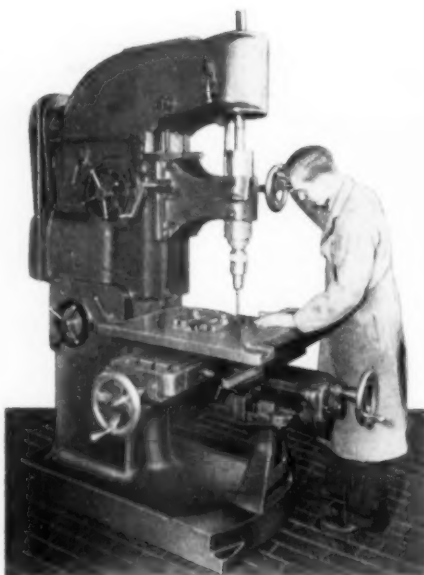
partment, is available to plants manufacturing shells, small arms ammunition, bombs, or other ordnance material of that type. It lists various types of gages that have been designed especially for inspection of shell and bomb parts. The folder includes many illustrations of the gages and shows line drawings of the work they are doing.

THE KNIGHT MILLER HAS BALANCED DESIGN

More Work . . .

Better Work . . .

In Less Time!



Drilling holes in large die plate prior to boring the same. Dial indicator being used on longitudinal movement to locate holes quickly and accurately without preliminary layout.

Knight Millers are built with the best of materials properly proportioned to provide plenty of strength and power for large work, yet not too cumbersome for small work. Also suited for handling a wide variety of work, the spindle drive has all proper speeds and feeds. The usefulness of the machine is increased through the table unit which can be swiveled and tilted.

Write for our Catalog!

W. B. KNIGHT MACHINERY CO.
3920 WEST PINE
SAINT LOUIS, MO.

(439) Bearings

McGill "Solidend" Multirol Bearings. 15 pp. McGill Manufacturing Company, Bearing Division, Valparaiso, Ind. Interesting applications of the "Solidend" bearing are shown through the use of line drawings in this catalog. Tables are included which show the size combination and dimensions and the lubrication holes, fillet radii and load capacity. A life expectancy chart is given and shaft and housing tolerances are mentioned. This catalog is completely illustrated.

(440) Die Sets

Leslie Self-Balancing, Positive Alignment Universal Die Sets for Press Brakes of All Sizes. Leslie Welding Company, 2943 Carroll Avenue, Chicago. This circular is made in convenient data sheet form for filing and gives the range of application, the construction, and features of the die set. Illustrations and line drawings are shown.

(441) Diamond Tools

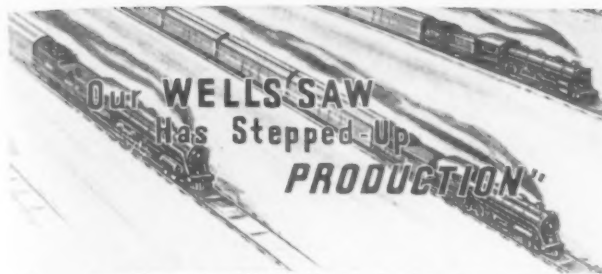
The Care and Maintenance of Diamond Tools. 24 pp. J. K. Smit & Sons, Inc., New York City. This illustrated booklet gives information regarding the truing and dressing of grinding wheels, instructions on diamond sizes, mounting, coolants, chatter, and taper. It also mentions the depth and speed of dressing, the "Sta-Kool" holder, and the "Dykon" gauge.

(442) Lubricating System

Trabon Reversing Lubricating System. 4 pp. Trabon Engineering Corporation, Cleveland, Ohio. A folder complete with engineering diagrams describes this single pipe centralized system that is said to lubricate all the connected bearings without employing springs, diaphragms, packing, or exposed moving parts. The folder is illustrated and applications are shown.

(443) Milling Machine

Douglas Plain Milling Machine. 4 pp. Douglas Machinery Company, Inc.,



"Since installing the Wells Metal Cutting Band Saw our records show increased production. It quickly cuts practically all metals, in all shapes. The men are satisfied — and I'm satisfied enough to order another."



WELLS SAWS
THE SAW AT SERVICE

That's the talk we hear from Wells users. This fast, sturdy, metal cutter, designed for today's productive speed, operates with minimum friction — without coolants. Long run tests show less than .005 inch variation per hundred samples. Write today for specifications of Wells Metal Cutting Band Saws Nos. 5 and 8.

A large stock of blades is available at all times

WELLS MANUFACTURING CORPORATION
THREE RIVERS, MICHIGAN

**WELLS METAL CUTTING
BAND SAWS**

FOR INTERCHANGEABLE MARKING USE
The "Champion"
STEEL TYPE HOLDER

The "Champion" steel type holder (Patented) permits rapid interchangeable marking of flat, curved, concave or convex surfaces... assuring alignment and perfect spacing of characters. Pressure of thumb on spring actuated button releases type for instant changing. Holder shown is hand style. Also made with shank, for press production marking.



Construction



Quick Changing

"Champion" Holders and "Tuf-Face" type are furnished in partitioned wooden boxes as illustrated, for easy handling and for keeping type in place. Cross-sectional view shows simple, fool proof type changing mechanism. Write for information and prices.

JAS. H. MATTHEWS & CO.

3945 FORBES ST. .: PITTSBURGH, PA.

New York—Chicago—Phila.—Boston—Detroit—Newark—Syracuse

DISTRICT SALES OFFICES • CLEVELAND • HARTFORD • BIRMINGHAM

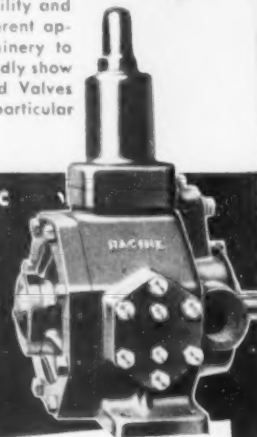
JULY, 1942

★ VERSATILITY ★ ★ ★ PLUS!

Outstanding among the many features of the Racine Variable Volume Hydraulic Pump is its ability to do a time-and-money saving job in an almost endless variety of applications.

Racine Pumps are proving their versatility and efficiency in hundreds of widely different applications ranging from mining machinery to plastic molding. Our engineers will gladly show you how Racine Hydraulic Pumps and Valves can be profitably applied to your particular plant or industry. Write today!

DEPENDABLE VARIABLE HYDRAULIC POWER! Delivering hydraulic power in 12-20-30 gal. per minute capacities, Racine Pumps automatically maintain any desired pressure up to 1000 lbs. per sq. in. without by passing of oil. Racine's variable volume feature reduces horse-power consumption, lessens oil heating. Simplified construction provides smoother, quieter operation, lasting dependability.



RACINE
TOOL AND MACHINE COMPANY
1777 State Street • Racine, Wisconsin
WRITE FOR NEW FREE CATALOG P-10-A

COPPERHEAD LAPS
for
**ACCURACY
ECONOMY
SPEED**



Practical and scientific design of Boyar-Schultz COPPERHEAD LAPS assures Accuracy in lapping holes.

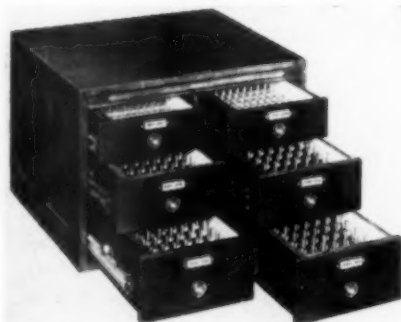
Copper sleeve, the only wearing part, is quickly renewable resulting in economy.

Abrasive compound works into the copper sleeve providing a medium that laps with speed. Sizes 1/8" to 2 1/2".

Write for Circular

BOYAR - SCHULTZ CORPORATION
2116-G Walnut Street Chicago, Illinois

USE DUB|IFE[★] PLUG GAGES * REG. U.S. PAT. OFF. FOR TWICE THE LIFE



**"UPPCO[★]
LAPPED"
THE LAST
WORD IN
FINISH!**



Complete in every detail, this set of 471 plug gages with a mahogany finished cabinet! In sizes from .030 to and including .501, these plug gages are single end, plain limit, with ends reversible. Six "easy-to-move" cabinet drawers on rollers for the gages. The cabinet has a receding door which can be locked when not in use.

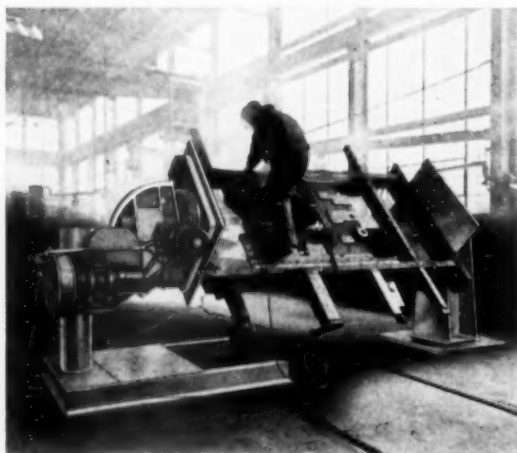
**"PLUG GAGE SPECIALISTS"
UNITED PRECISION PRODUCTS CO.**

4617 W. HURON STREET

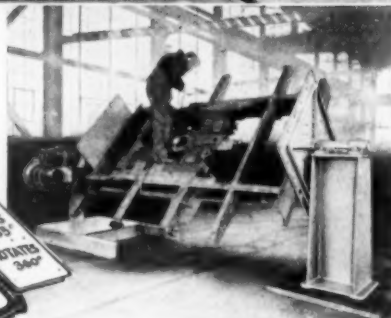
CHICAGO, ILL.

FASTER, DOWN-HAND WELDING

TURNING A WELDMENT FOR BETTER,



A



B



CULLEN-FRIESTEDT CO.,
1518 S. KILBOURN AVE. CHICAGO, ILLINOIS

• Cullen-Friestedt

Positioners equipped with a "tailstock," (a free-turning platen mounted on a suitable stand) permits a complete rotation of heavy awkward weldments so that faster, better down-hand welding may be done. "A" shows positioner end of this set-up and "B" the other end showing the tailstock. With push-button switch, the welder has complete control of turning speed and starting and stopping at convenient welding positions.

• Our NEW booklet WP 21 is just off the press giving full information about C-F Positioners in four sizes from 1200 to 14,000 lbs., capacity. Write for it.

—NEW LITERATURE—

150 Broadway, New York City. This folder gives the description of the drive, column, knee, table, spindle, speeds and feeds of the machine. The machine is illustrated and the complete specifications are given.

(444) Metal Cutting Machine

The New DeWalt High-Speed Metal Cut-Off Machine. 6 pp. DeWalt Products Corporation, Lancaster, Pa. This folder describes a new metal cutting machine that uses either a saw blade or an abrasive wheel for cutting. This machine is illustrated and the general specifications are given.

(445) Plating

Hard Chromium Plating. 16 pp. United Chromium, Inc., 51 East 42nd Street, New York City. Summarizing the applications where industrial chromium plating saves materials and man-hours in the production and maintenance of metal products, this bulletin gives specific examples of how production-rejects and metal-working tools are being salvaged. It also tells how the service life of tools, gauges, and wearing parts can be greatly increased and how hard-to-get equipment parts and tools are being reclaimed when worn. It offers suggestions on how existing plating equipment can be converted to "hard" chromium plating for war production.

(446) Furnaces

Huppert Heat Treating and Laboratory Furnaces. 20 pp. K. H. Huppert, 164 W. Walton Street, Chicago. In this catalog a page is devoted to each model of furnace. Each model is illustrated, described, and the specifications are given. The catalog includes a price list for the furnaces.

(447) Live Centers

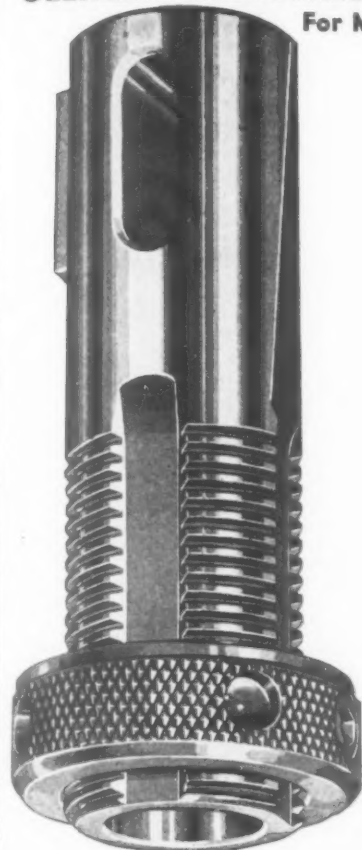
Sturdimatic Heavy Duty Live Centers for Lathes, Grinders, Milling Machines, and Screw Machines. 4 pp. Sturdimatic Tool Company, 5224 Third Avenue, Detroit. This catalog gives complete information and specifications concerning standard Morse taper live centers. Illustrations are given and line drawings show the workings of special centers for unusual work. Also included is a chart on the dimensions of the centers.

(448) Synchronous Motor

"HG" Synchronous Motor. 4 pp. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Describing the synchronous motor for coupled, belted, and geared service, this booklet lists the operating characteristics of the motor and stresses distinctive features, construction, and application.

THE TOOL ENGINEER

GLENZER ADJUSTABLE ADAPTERS For Multiple Spindles



STANDARD
EQUIPMENT
FOR ALL
DRILLING
REAMING
AND TAPPING
MACHINES.

ADOPTED AS
STANDARD
BY LEADING
AUTOMOTIVE
AND MACHINE
TOOL
MANUFACTURERS

**Utility
Tools**

THE
J. C. GLENZER
COMPANY
6463-6477
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DETROIT
MICHIGAN

Send for Valuable Booklet

Forgings For All Industries
Rough Turned or Finished Complete



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Composite Die
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Crankshaft Forgings
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Rings, Discs, Blocks,
Shafts, Hubs, Bars,
and Special Shapes.
Tool Steel of all
Makes

S.A.E. Specifications

STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL & FORGE Co.

205 ADAIR STREET

DETROIT, MICHIGAN

JULY, 1942

Proven Performance

...in Tool Engineering

• Our experience working with the leading tool engineers of the country in planning to solve production problems is of value to you . . . in processing and designing of SPECIAL MACHINES . . . FIXTURES . . . JIGS . . . DIES . . . GAGES . . . and all types of precision equipment for vital emergency needs of the armed forces. More than a hundred high grade engineers on our staff to serve you. Production Products Co. CAN and DOES deliver! Write, wire or phone for quick action.

(Chicago Division . . . 2400 W. Madison St.)

PRODUCTION PRODUCTS CO.

Engineers of Complete Tooling Programs

104 EAST THIRD STREET • DAYTON, OHIO



Rawhide

HAMMERS

• As carefully made as the finest tool. Accurately balanced malleable iron heads on straight grained and polished hickory handles. Replaceable genuine Java Water Buffalo Rawhide faces which will not chip, shear, or split, providing a striking surface that is smooth and accurate to the last blow

Cat. No.	Diameter in inches	Weight in pounds
0	1	1/2
1	1 1/4	1 1/8
2	1 1/2	1 5/8
3	1 3/4	2 1/4
4	2	4
5	2 3/4	5 1/2

These are the tough, resilient, long-lasting Rawhide faces made from specially treated Java Water Buffalo hide for use in Chicago Rawhide Hammers.



Rawhide

MALLETS

• Chicago Rawhide Mallets have solid, hard rolled Java Water Buffalo Rawhide heads securely glued and riveted, fastened to hickory handles with steel forged pin. A tool that is finely balanced for accurate blows, made for long service and safe to use.

Not Loaded			
Cat. No.	Diameter Inches	Length Inches	Weight Ozs
0	1	2 1/8	2
1	1 1/4	3	3 1/2
2	1 1/2	3 1/4	6
3	1 3/4	3 1/4	7 1/2
4	2	3 1/2	10
5	2 3/4	4 1/4	21
6	2 3/4	4 3/4	23
Loaded Mallets			
7	1 1/4	3	8
8	1 1/2	3 1/8	12
9	1 3/4	3 1/8	16
10	2	3 1/2	20
11	2 3/4	4 1/4	42

CHICAGO *Rawhide* MFG. CO.

1393 ELSTON AVE.

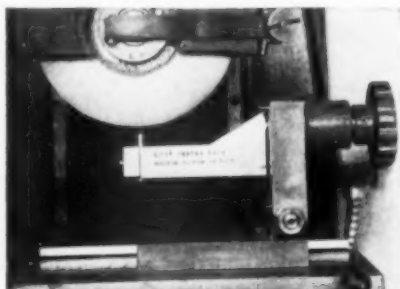


CHICAGO, ILLINOIS.

"C-66"

RADIUS DRESSER

for Surface Grinders



The C-66 will accurately dress wheels to both male and female radii operations. Is open and easy to see. Avoids necessity of removing guard since wheel is dressed from below.

The C-66 is a low-priced, rugged attachment for any make of surface grinder. Mounts directly on magnetic chuck. Dresses wheel without dismantling machine—a one hour job in ten minutes! This Radius Dresser is capable of dressing a 9/16" male radius and unlimited female dressing. Simple, easy and quick!

Prompt delivery from factory in Newark.
Price, without diamond, \$72.50; 1/4K diamond, \$5.00.

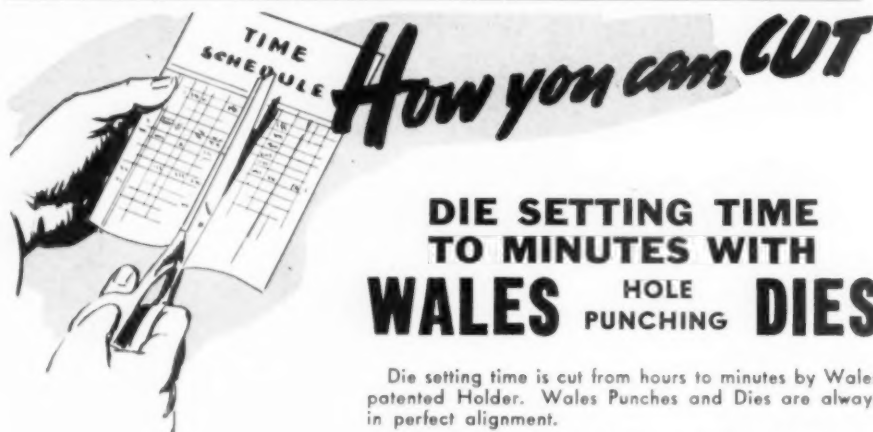
Write Today For Complete Information

SCHULTZ & ANDERSON CO.

MACHINE TOOLS

109 B EDISON PLACE

NEWARK, N. J.



DIE SETTING TIME TO MINUTES WITH WALES HOLE PUNCHING DIES

Die setting time is cut from hours to minutes by Wales patented Holder. Wales Punches and Dies are always in perfect alignment.

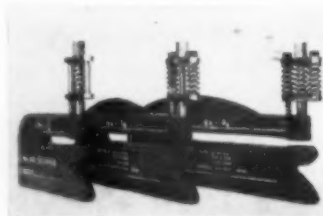
FOR PATTERNS UNLIMITED each individual holder can be reset or removed from rail, template, or T-slotted plate quickly. This provides practically continuous press operation by making it possible to slide one set-up out of the press and another set-up into position. Nothing is attached to press ram.

Wales Punches and Dies are available in a wide range of standard sizes and shapes. There's always something new in the Wales Line. Keep posted by writing to —

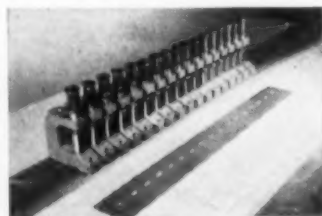
THE STRIPPIT CORPORATION

George F. Wales, President
BUFFALO, N. Y.

Specialists in Punching and Notching Equipment

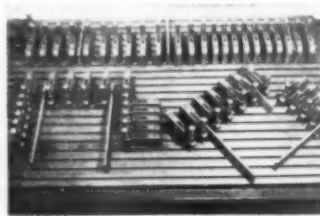


Above shows Wales "Selective Strippers" of 1, 2, or 3 interchangeable springs for exact stripping action for each job.



Line-up of Wales Punch and Die Holders mounted on press rail.

Showing 3 set-ups of Wales Dies on one T-slotted plate.



NEW LITERATURE

Seven illustrations show the various parts of the motor and each is described in detail.

(449) Plant Efficiency

Plant Efficiency—Ideas and Suggestions on Increasing Efficiency in Smaller Plants. War Production Board. Chapters in the booklet deal with subjects such as: adapting old machines to new jobs; maintenance and repair; longer life for cutting tools; getting the most out of machine tools; meeting government standards; training workers quickly; and pooling facilities.

(450) Twin Ram Unit

Twin Ram Master. 4 pp. Le Maire Tool and Manufacturing Company, Dearborn, Michigan. Giving complete specifications, line drawings of operations, illustrations, and applications, this folder completely describes a twin ram master unit, available in two sizes, for drilling, reaming, boring, counter-boring, and spotfacing.

(451) Cutting Tools

Standard Tools for General Shop Use. 8 pp. Carbide Fabricators, Berkley, Michigan. Made in data sheet form for filing purposes, this folder presents a listing of standard cutting tools, simplified as to size and price range. This folder is illustrated and includes many line drawings. Also shown are special carbide tipped tools.

(452) Thread Grinding

How to Solve Thread Grinding Problems. 4 pp. Macklin Company, Jackson, Michigan. This folder gives a typical case study of a thread grinding job handled by a grinding wheel sales engineer of the Macklin Company. Charts on wheel speed, work speed, and result are given.

(453) Tin Bronze

Alternate Specifications for Tin Bronze. 1 page. Ampco Metal, Inc., Milwaukee, Wisconsin. This is an engineering data sheet for filing. It tells of materials to be substituted for tin bronze. A chart giving the nominal composition and physical properties of copper base alloys is included and shows the tin bronze alloys and suggested alternates.

(454) Gage Blocks

The Care of Gage Blocks. 4 pp. The George Scherr Company, 128 Lafayette Street, New York City. The purpose of this booklet is to reveal up-to-the-minute methods of increasing the usefulness and life of gage blocks. Toolmakers working with precision length standards can find information in this study.

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NEW LITERATURE

(455) Industrial Safety

Safety Simply a Matter of Horse Sense. 4 pp. A. Schrader's Son, 470 Vanderbilt Avenue, Brooklyn, N. Y. Prepared for industrial engineers interested in both production and safety, this pamphlet gives information on equipment designed to reduce accidents through the use of compressed air. The safety installations described in the folder are said to be easy to install and operate.

(456) Grinding

Boost Production On Your O. D. Grinding Jobs . . . Centerless and Cylindrical. 6 pp. Norton Company, Worcester, Mass. This folder is illustrated and describes grinding on traverse and plunge-cut jobs. The Norton "B-E" Bond wheel is described. A complete list is included which gives the wheels for O. D. grinding, cylindrical and centerless, and lists the material which each is suited for.

(457) Service From Cutting Tools

Kennametal Vest Pocket Manual. 48 pp. McKenna Metals Company, 189 Lloyd Avenue, Latrobe, Pa. The new manual contains chapters on selecting, designing, using, brazing, and grinding Kennametal tools. Instructions show how to get the most in service from all types of Kennametal steel-cutting carbide tools. It includes more than 100 illustrations.

(458) Lubrication

Industrial Lubricating Equipment. The Aro Equipment Corporation, Bryan, Ohio. This catalog illustrates and describes a line of pneumatic, electric, and hand operated units, stationary and portable models, to meet the requirements of both large and small plants in applying lubricants.

(459) Grinding

Work Done On the Blanchard. 80 pp. The Blanchard Machine Company, 64 State Street, Cambridge, Mass. This booklet gives many typical examples of the machining and finishing of flat surfaces by Blanchard grinding. The booklet is full of illustrations and wheel data is included in the index at the back of the book.

NEW BOOKS

Plane Trigonometry Made Plain by Albert B. Carson, Instructor of Mathematics, Louisiana State University. 389 pp. \$2.75. American Technical Society, Drexel Avenue at 58th Street, Chicago, Ill.

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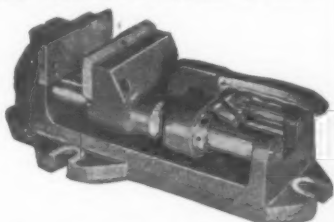


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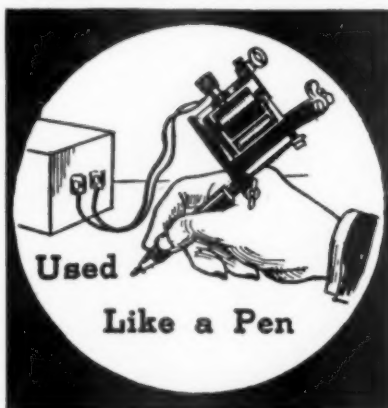
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HANDY ANDY SAYS

(Continued from page 168)

tively speaking) who will probably go a long way in the editorial field before they're through. Either that, or they'll make the diplomatic corps. All of them, it seems, are obsessed with the idea that I'm temperamental like some Tool Engineers we know and they treat me accordingly.

One of 'em—Al Cochrane and Scotch—you saw down in St. Louis, taking pics of the celebrities. He runs somewhat to avoidupois and pleasant disposition. Tother one, dispositioned ditto but ranging more to longitude, is Jerry Wilford and steeped in printers' ink instead of hypo. The third, Wallace Scotten, parallels Jerry; both run to high brows, smoke pipes like English movie actors and wear bow ties like regular journalists. Oh, I tell you! Well, that completes introductions; you can now call 'em by their first names.

Now, I've had a lot of ribbing about my handwriting — which, incidentally, is perfectly legible once you get the hang of it—and those *ex-printers devils* joined the anvil chorus along with Otto Winter and Doug Burnside. But oh, so diplomatically! Jerry, for one, wrote me a note, and—oh well, skip it. But when I've deciphered it I'm going to take up Egyptian hieroglyphics and Assyrian cuneiform, just by way of diversion. Pan my handwriting, will he! But let me take you into the editorial sanctum, which happens to be wherever we meet, although officially at *The Bramson Publishing Co.* The other Sunday Jerry came to my house, me having an intimate date with my granddaughter, as cute a trick—but then, I'll not brag. Besides, Jerry might have opinions of his own, considering that he's a recent paterfamilias and not once removed, like myself. Anyway, the two man editorial session was plenty interrupted; between burping and diapering you'd think we were editing material for the *Ladies' Magazine* instead of deep stuff for a technical journal like *THE TOOL ENGINEER*. Yessir, men, the women are a great help when it comes to raising babies, as you discover when you have to spell 'em on nursing chores. Ask Dad — he knows.

Handily yours

THE TOOL ENGINEER

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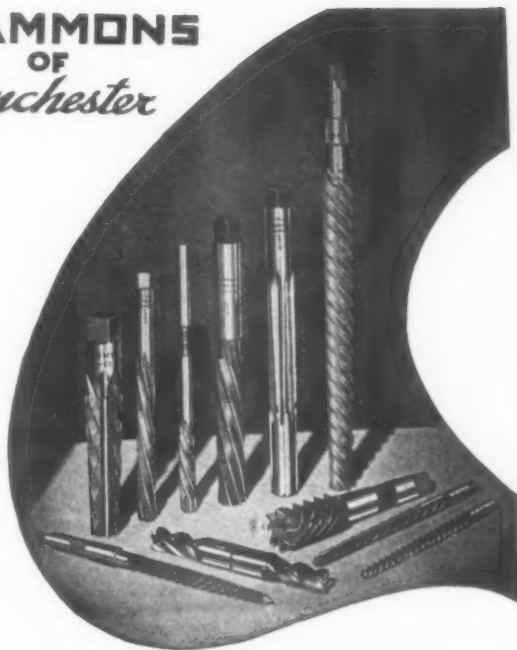
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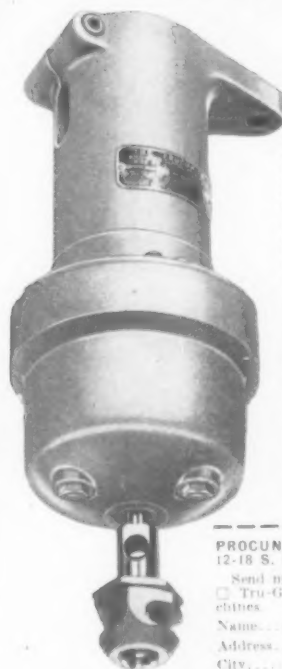
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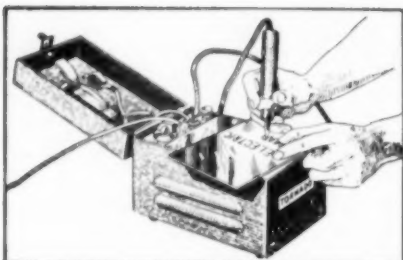
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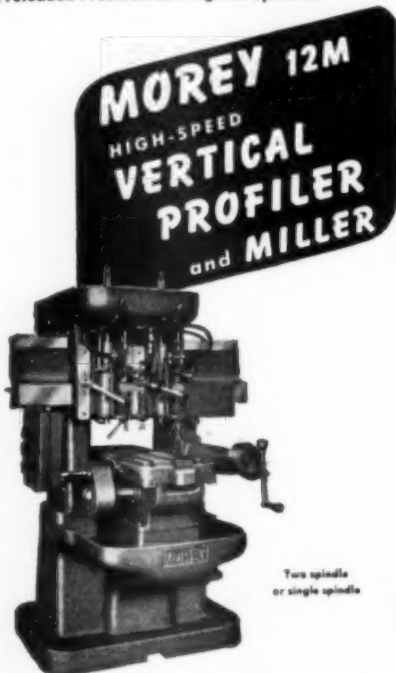
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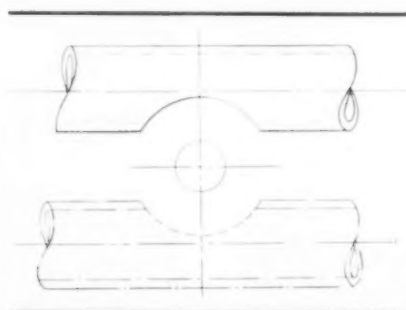
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Cutting a Segment From Tubing with a Counterbore

To cut a segment from tubing, the first thought might be to mill, as



shown in the solid line drawing at top. Actually, the job can be done faster and cheaper if machined by counterboring two at a time in a drill press. V-blocks, (or radius nesting), on a plain plate base, simple clamps, end locations and a piloted tool, running in a standard bushing suffices. Entire drawing shows how tubes are clamped to base, for machining two at a time.

Sliding keys or splines, slightly over or undersized, can be lubricated advantageously with castor oil.

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There is a persistent fallacy in the thinking of some engineers that a general assembly drawing of a fixture suffices for its manufacture. It does, in the long run, but right now we cannot afford the long run. We must cut time, corners and costs.

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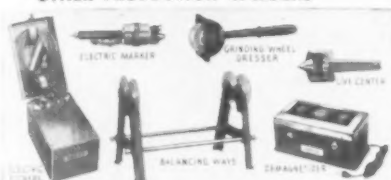
Get more work, quicker, out of lathes, millers, grinders, etc. with IDEAL Live Centers. They rotate with the work, and therefore permit heavier loads—faster speeds—deeper cuts. The radial load is carried by a high precision ball bearing, and thrust load absorbed by a taper roller bearing. All parts are hardened and ground.

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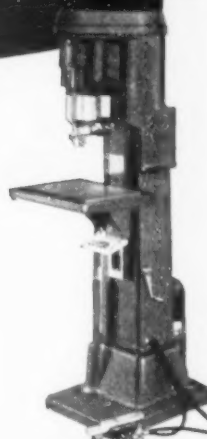
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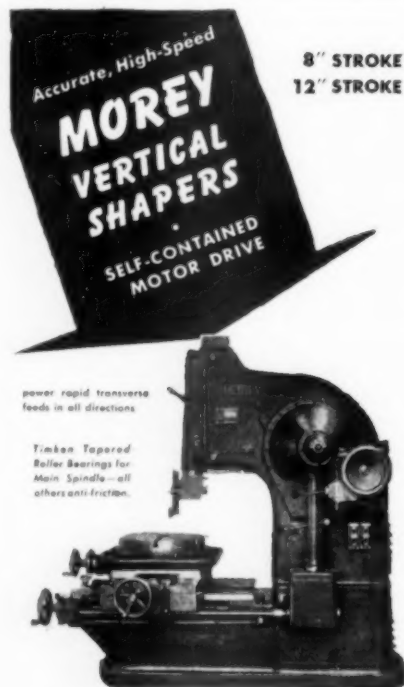
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THE CRIB

by a harassed tool room foreman, without checking and with this extra work added to the tool room costs.

While the foreman or toolmaker may be entirely competent to pick out the parts from an assembly, it is not the business of either to do so. If it were, they should be in the engineering office, which incidentally may be benefited by men who can both design and build.

No, the detailing belongs to the engineering office, where weaknesses and bugs stick out like sore thumbs. And right here, thumbs down on free-hand sketches. There is nothing so deceiving as a free-hand sketch which too often falls short of its promise. Do a job right and save regrets.

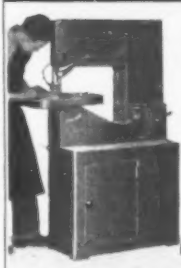
Pre-loading a fixture, where complicated parts require time to jig, can be done by a helper. Machines are kept busy during otherwise idle time. Try it for increased production.

Making a Real Crib

The editors of THE TOOL ENGINEER are well pleased with the response to this feature which began in the June issue. Readers have not only begun to contribute material—they have asked that this feature be a real crib, where a stock of ideas will be on file. Tool Engineers who want to take the kinks out of an everyday production or tool problem may find an answer by writing to The Crib, c/o THE TOOL ENGINEER, Bramson Publishing Company, 2842 West Grand Boulevard, Detroit, Michigan. If the subject has been covered in this column, the editors will be glad to get the idea out of The Crib and pass it on. Tool checks? You bet. Along with your request, send an item about some shop short-cut that you are using or know about. It's all in your favor. If the item is published, you get a check for \$5.00.

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PLAIN MILLER

FOR SMALL PARTS PRODUCTION

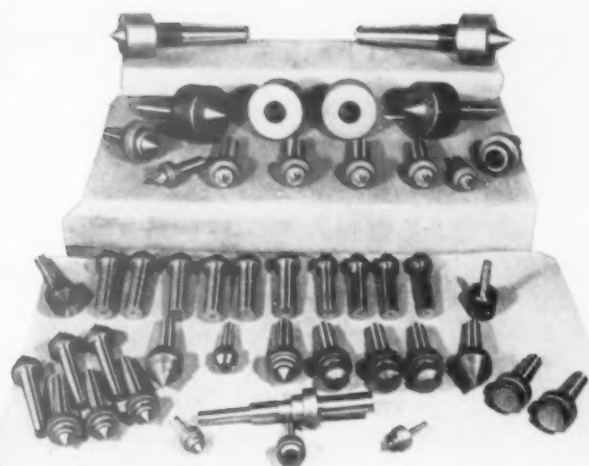


WIDE RANGE OF
SPINDLE SPEEDS from
75 to 1200 R.P.M.

TABLE SIZE
32" x 8"

QUICK DELIVERY
BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.
150 BROADWAY NEW YORK, N. Y.



**If we design the CENTER—
you won't be in the MIDDLE**

A properly engineered LIVE CENTER is one of the fundamentals of setting up a job and requires a specialists experience . . . Our engineering is based upon forty years of tooling for metal working operations.

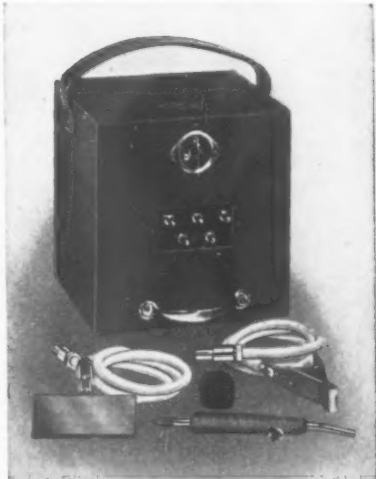
Send us your specifications and blueprints . . . we will see that your job is set-up with the right Live Center.

**STURDIMATIC
TOOL COMPANY**
5218 THIRD AVE. DETROIT, MICH.

Mark Iron,
Steel and
Carbides the

Etchograph
Way

2000 IN USE



NEW JUNIOR MODEL

Buy the Original Electric Etcher

Three sizes to meet all requirements. Also a combined Etchograph and Demagnetizer.

With New ELKONITE TIP Pencil

Mark hardened parts, tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides — quickly — plainly.

Write for circulars and prices.

BREWSTER-SQUIRES COMPANY
54 Church Street
NEW YORK, N. Y. U. S. A.



**UNIVERSAL BUSHINGS
WORK FOR UNCLE SAM**

Drill Bushings are a small but important cog in the precision manufacture of war equipment being built today for Uncle Sam. Because of their straight and round super-finished bores Universal Bushings assure accuracy and unexcelled wearing qualities. Write for facts.



UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN



Photo courtesy Minneapolis-Honeywell

METAL DUPLICATING *Without Dies*

Users of Di-Acro Precision Machines—Shears, Brakes, Benders—are constantly showing us new time-saving, cost-cutting applications, in experimental work for making small quantities of parts, or even production runs. They often save expense and delay of making dies, or parts of progressive die sets. They do many things dies cannot do.

Photo shows Di-Acro Shear No. 1, which squares up stampings, cuts strips, makes slits or notches. All work accurate to .001".

Get New Catalog

It shows Di-Acro Shears, Brakes, Benders. Illustrates many parts which can be made with this creative, flexible system of "Metal Duplicating Without Dies".

O'Neil-Irwin Mfg. Co.
307—8th Ave. S.,
Minneapolis, Minn.



LESS OPERATIONS AND FAR BETTER WORK WITH A

GATCO

ROTARY PILOT BUSHING

Pilot and bushing fits with a PUSH fit, therefore a perfect bore

ROUND-CHATTERLESS-SMOOTH



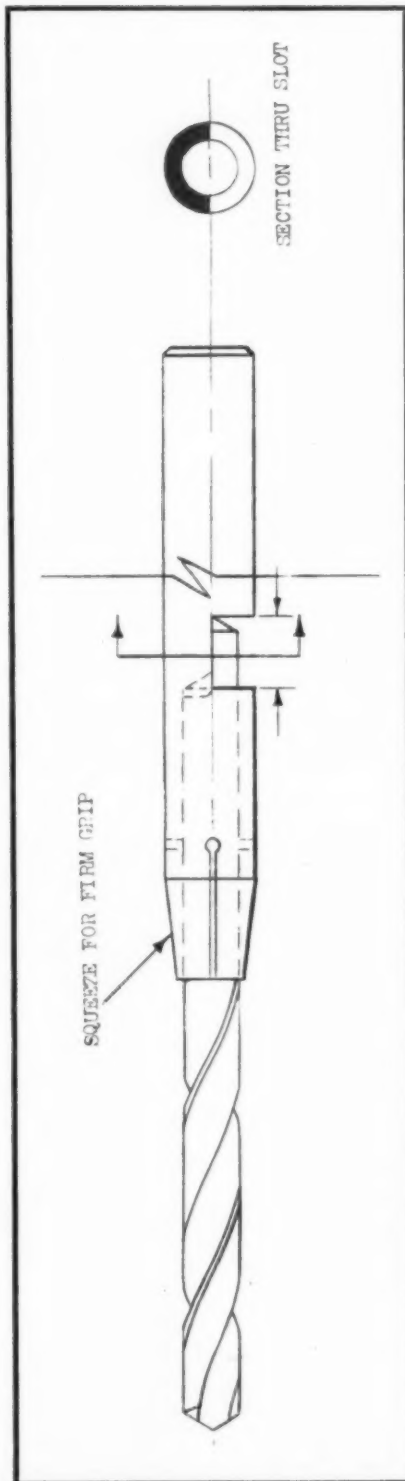
GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

Write for full information and prices

GIERN & ANHOLTT TOOL COMPANY
1312 Mt. Elliott Avenue, Detroit, Michigan

THE CRIB

Simple Drill Lengthener for Pocketed Holes



Do You Have an Idea For THE CRIB? ? ?

THE TOOL ENGINEER will pay \$5.00 for your kinks or shop shortcuts published in this column. Brief, practical articles should be accompanied by sketches or photos if idea cannot be vividly described in type alone.

HIGH SPEED TAPS

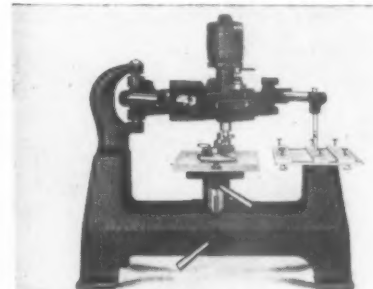
NOW ON CRITICAL LIST. KEEP THOSE NOW IN SERVICE 100% EFFICIENT BY PROPER SHARPENING.



THIS NO. 12 GRAND RAPIDS
TAP GRINDER MAKES THE
JOB A SIMPLE ONE.

Bulletin on request

GALLMEYER & LIVINGSTON CO.
110 Straight Ave., SW
GRAND RAPIDS MICHIGAN



**ENGRAVING,
ACID ETCHING,
ELECTRIC MARKING**

... All three with one
machine ... the PANTO

A compact precision bench-type pantographic machine, with interchangeable heads... for engraving instrument dials, name plates, etc... and for acid etching or electrically marking tools and parts—heat-treated or annealed—on flat, concave, or convex surfaces.

Illustration shows machine with engraving head attached.

» Write for Literature

H. P. PREIS ENGRAVING MACHINE CO.
161C SUMMIT ST. NEWARK, NEW JERSEY

DON'T WAIT FOR TURRET LATHES



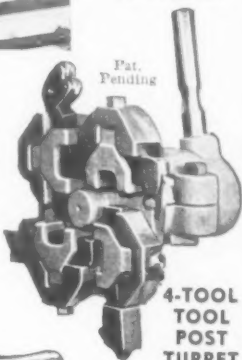
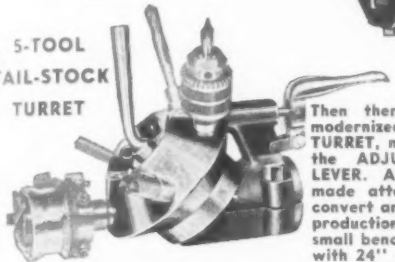
Photo Shows Turrets on 16" Lathe

Convert Your
ENGINE LATHE
into a
TURRET LATHE
in
15 Seconds

This new modern TOOL-POST TURRET, made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard made tool holders which can be easily inserted and rigidly held.

Delivery 15 Days

5-TOOL
TAIL-STOCK
TURRET



Pat.
Pending

4-TOOL
TOOL
POST
TURRET

Then there's the completely modernized 5 Tool TAIL-STOCK TURRET, made in 4 sizes. Also the ADJUSTABLE PULL-FEED LEVER. All tools are precision made attachments which will convert any engine lathe into a production turret lathe. To fit small bench lathes up to lathes with 24" swing.

Write for bulletin of these and other JEFFERSON TOOLS.

JEFFERSON MACHINE TOOL CO.
669-679 W. 4th ST. CINCINNATI, OHIO

CERRO ALLOYS for Prompt Shipment

CERROMATRIX (Melting Temp., 250° F.) for securing punch and die parts, anchoring machine parts without expensive drive fits, for engraving machine models, stripper plates, chucks, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp., 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

These two low-temperature-melting and expanding alloys are helping to speed up production of war materials for the Army, Navy and Air Force.

REPRESENTATIVES AND DISTRIBUTORS

BROOKLYN, N. Y., Belmont Smelting & Refining Works
ANSONIA, CONN., Jackson Associates
BOSTON, MASS., Jackson Associates
CHICAGO, ILL., Sterling Products Co., Inc.
CLEVELAND, O., Die Supply Co.
DALLAS, TEX., Metal Goods Corporation
DETROIT, MICH., Castaloy Corporation
HOUSTON, TEX., Metal Goods Corporation
KANSAS CITY, MO., Metal Goods Corporation
LONDON, ENG., Mining & Chemical Products, Ltd.
LOS ANGELES, CAL., Castaloy Corporation
MILWAUKEE, WISC., Harry C. Kettelson, Inc.
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MONTREAL, CAN., Dominion Merchants Ltd.
NEW ORLEANS, LA., Metal Goods Corporation
PHILADELPHIA, PA., Machine & Tool Designing Co.
ST. LOUIS, MO., Metal Goods Corporation

CERRO DE PASCO COPPER CORPORATION
40 WALL STREET - - NEW YORK, N. Y.



Again
TAFT-PEIRCE
Makes News

this time in **ROTARY** Surface Grinding

SHARP ADVANCES in output, quality, and economy of small rotary surface grinding work are now accomplished facts. The 6" Rotary Surface Grinder produces, almost effortlessly, surfaces which are flat to extremely close tolerances . . . Long life is underwritten by hardened and ground ways, ball-bearing construction.

Wheel-spindle swivels in a vertical plane from horizontal to 30° below wheel-center. Spindle-block may be adjusted for operations formerly requiring difficult tool set-ups. In sum, the Taft-Peirce 6" Rotary Surface Grinder establishes new high levels of precision in grinding the plane surfaces of small parts and tools.

THE TAFT-PEIRCE MFG. CO., WOONSOCKET, RHODE ISLAND

Hanna Hydraulic Cylinders



• Bored to a concentric, mirror finish and fitted with rings for oil service—"U" packings for water—they give long-lasting, leak-proof service. Built for operation at pressures up to 1,500 lbs. p.s.i. they are available in many types to suit your requirements. Write for catalog 229.

HANNA ENGINEERING WORKS
1765 ELSTON AVE. • CHICAGO, ILL.

THE PASSING PARADE

The Ever-Changing Scene in Mass Manufacturing



CLYDE MOONEY, formerly assistant chief engineer of Pioneer Engineering for six years, is now the chief engineer of the American Designing and Engineering Company Detroit. Mooney has been prominent in Tool Engineering circles for the past 14 years, serving in various capacities in the engineering departments of local automobile plants.

He was elected chairman of the Detroit Chapter of the A.S.T.E. for the 1942-43 term.

WILLIAM F. MURRAY succeeds **WILLIAM PARK WOODSIDE** as President of the American Twist Drill Company. Mr. Woodside is now chairman of the board.

C. W. SPITTAL and **W. R. BREE-**



CLYDE MOONEY
Now chief engineer.

LER have been made General Manager and Assistant General Manager respectively of The Allegheny Ludlum Steel Corporation's Dunkirk, New York, plants. **C. COTTRELL** and **MERLE GRAHAM** have been named Production Managers of these plants. At the same time, the appointment of **W. H. NORRIS** was announced as Manager of the Watervliet, New York, plant, with **J. Q. A. DOOLITTLE** as Assistant Manager and **G. ANDERSON** as Production Manager.

HAROLD NORDBERG, **A. A. JANS-SON**, **R. M. WRIGHT**, and **A. F. PEAR-SON** are president, 1st vice-president, 2nd vice-president, and secretary-treasurer, respectively of the Jansson Gage Company which has opened a new Detroit plant. This new plant will be devoted exclusively to the manufacture of precision blocks and thread gages for use in war production.



WALTER WAGNER
Now at bomber plant.

WALTER WAGNER, formerly Master Mechanic at the Lincoln Division of the Ford Motor Company and a past president of the A.S.T.E., has been transferred to the Ford Bomber plant where he was stepped up to a superintendency.

ALFRED SONTAG has joined the

THE TOOL ENGINEER



Airplane strut seat of .031" brass produced complete one per stroke at new high rate.

Dieing Machines help keep 'em FLYING and SHOOTING!

Reaching new highs in production of precision stampings, the Dieing Machine is helping our 'planes reach new highs in efficiency of operation and fire-power. Dieing Machines produce COMPLETE PER STROKE numerous intricate items for airplanes fuselage, engine and instrument components, holding the stamped product within limits of .0002" when required. In addition, these automatic presses produce most of the machine gun belt links, plus a wide variety of munitions items which may require 8 or more operations of blanking, piercing, forming, drawing, coining, extruding, broaching—all combined COMPLETE PER STROKE. Capacities: 10 tons to 300 tons.

Request Catalog 42

THE HENRY & WRIGHT MFG. CO.

HENRY & WRIGHT DIEING MACHINES

Intricate stampings complete per stroke

STAMPINGS

Airplane instrument, engine and fuselage parts
Mechanical time and contact fuse parts
Rifle components
Cartridge clips, or rifle chargers
Gas mask stampings
Ammunition stampings
Bomb components
Shell parts
Detonator stampings

OPERATIONS

Bullet assembling
Primer inserting
Automatic time and contact fuse assemblies



INCLUDING BROACHING

Airplane fuselage hinge of duralumin produced complete per stroke in continuous strip to precision limits including BROACHING operation.



Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.



Of various cartridge clips produced on Dieing Machines, this one is for caliber .303 rifle produced from flat material complete one per stroke at exceptionally high rate.

444 WINDSOR ST.,
HARTFORD, CONN.

UNIVERSAL CENTERING CHUCKS AND STANDARD CHUCKS STEP UP ACCURACY—INCREASE SPEED



Above: Universal Centering Chucks convert a drill press into a centering machine. Furnished with a set of bushings and collets for various size center drilling. Accurate and sturdy. Depth adjustment for centers. Write for facts.



Above: Universal Standard Collet Chucks hold tools in a grip as strong as solid steel itself. Nut for spanner wrench. The ideal tool for holding end mills, keyway cutters, drills, etc. Write for facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

ARMSTRONG

**Conserve High Speed Steel
with ARMSTRONG TOOL
HOLDERS**

Not only in the tool room and machine shop, but for many operations on strictly production tools you can make your high speed steel go 10 times as far by using ARMSTRONG TOOL HOLDERS because each ounce of high speed steel used in an ARMSTRONG TOOL HOLDER does the work of 10 ounces in a forged tool.

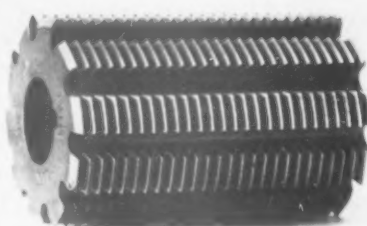
The "Armstrong System" comprising Armstrong Tool Holders in hundreds of sizes and shapes provides permanent multi-purpose tools with strength to stand up to any speed or feed, tools for every operation on lathes, planers, sloters and shapers and for many operations on engine lathes, turret lathes and screw machines.

Use ARMSTRONG TOOL HOLDERS wherever possible and "Save". All Forging, 70% Grinding and 90% High Speed Steel.

Armstrong Bros. Tool Co.
"The Tool Holder People"
360 N. Francisco Avenue
CHICAGO, U. S. A.
Eastern Warehouse & Sales:
199 Lafayette Street, New York

Write for
Catalog showing
250 Tool Holders

MULTIPLE THREAD MILLING HOBS



—in any thread system, any thread angle, any thread form. Inch or metric scale. Left or right hand threads. Free from distortion. Up to 7" O.D., and 4" thread length for internal or external threading.

**TOLERANCES: FOR THREAD DEPTHS AND PITCHES
LESS THAN 1/10,000 INCH**

These hobs precision cut by methods used for more than 25 years, eliminating any discrepancy between thread form and form of finished work, thus speeding up production without sacrificing accuracy. Full details upon request to Dept. T.

DELIVERY TIME: FROM 1 WEEK ON

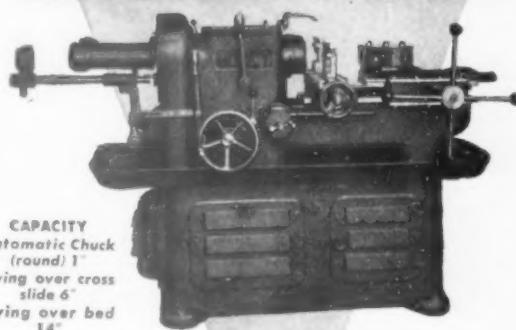
U. S. MACHINE TOOL MFG. CORPORATION

DEPT. T

100 So. 6th Street, Terre Haute, Ind.

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G Back-Geared TURRET LATHE Timken Bearing Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck
(round) 1"
Swing over cross
slide 6"
Swing over bed
14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

staff of the testing machine department of the Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia.

PAUL E. CHATELAIN is now in charge of engineering development of the various machine tools being manufactured and to be produced by the Wickman Corporation in Detroit. Mr. Chatelain is Engineer on Special Assignment for the A. C. Wickman Company, Ltd., of Coventry, England.

CLIFFORD IVES, formerly State Director, Wisconsin, WPB, is now in Chi-

cago as WPB assistant for the entire Chicago Ordnance District. All WPB business is now handled by the Ordnance Districts and the Chicago WPB office handles Northern Indiana, Wisconsin, Iowa, Illinois, and Minnesota.

GEORGE KENTIS, JR. has been promoted to the post of Chief Engineer of The Yoder Company of Cleveland. With Yoder for 12 years, Mr. Kentis advanced to the position of Chief Engineer from the superintendency of the boring mill division.



GEORGE KENTIS, JR.
Yoder's chief engineer.

H. N. ARBUTHNOT has been named as assistant general sales manager of the Allegheny Ludlum Steel Corporation. With Allegheny Ludlum for 16 years, Mr. Arbuthnot was Detroit district manager prior to this appointment.



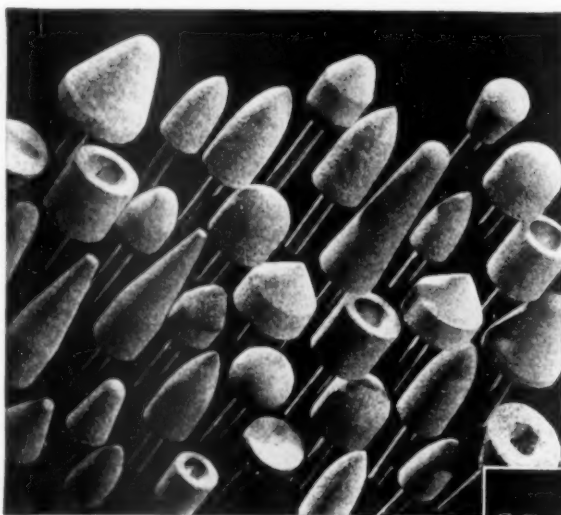
H. N. ARBUTHNOT
Leaves Detroit.

HARRY M. BERG, who has been a tool designer and more recently in charge of processing at the Briggs Manufacturing Company, now heads his own company known as the Berg Engineering Service, Detroit.

D. D. BURNSIDE has left his position as Industrial Consultant of the Plumbing and Heating Branch of the WPB in Washington to return to St. Louis. He will take over his former job as superintendent of the American Stove Company.

O. B. JONES, founder of A.S.T.E. and president of Detroit College of Applied Science, Detroit, has recently established the O. B. Engineering Company. The company is operated as an organization distinct and separate from the college although it will be housed in the new building now under construction. The O. B. designing staff is composed of electrical, mechanical, hydraulic and tool and production engineers whose specialty has been, and will continue to be, the solution of unusual production and inspection problems.

FINISHING THE *JOB* BEHIND THE LINES



CHICAGO MOUNTED WHEELS

Made of V/T Super Bond, they have real stamina, give unmatched performance and last 150% to 300% longer than ordinary wheels.

Chicago Wheels were the first small wheels mounted on steel shanks. Today there are over 200 different shapes to serve you—made in a variety of abrasives, grains, grades, mounted on shanks of various lengths and diameters of 1/4", 3/32", 1/8" and 3/16".

TRY ONE ABSOLUTELY FREE

Tell us the kind of job, size and wheel speed you use, and we'll send you a test wheel postpaid.

BRAND NEW CATALOG

Just off the press, this book is prepared in the modern manner—loads of illustrations, concise descriptions of the complete line of Chicago Mounted Wheels. Send for copy.

CHICAGO WHEEL & MFG. CO.

Makers of Quality Products for 40 Years
1101 W. Monroe St., Dept. TE, Chicago, Ill.

Keeping up with Uncle Sam's victory drive for more tanks and guns and planes, Chicago Mounted Wheels are doing a big finishing job in shops everywhere—taking care of every kind of delicate or tough grinding job faster, smoother and better.



HI-POWER GRINDER

A real production grinder that is saving many man hours. Weighs 3 pounds, yet is so well balanced that fatigue is practically eliminated. Has enough power to drive a 2 1/2" diam. wheel. Speed 17,000 r.p.m. In case with 3 Chicago Mounted Wheels, Drum Sander and Bands, extra Collets, Wrenches, Dressing Stone, \$38.50.

What's a good HOTEL IN DETROIT?



We're glad you asked . . . because there's more than one good hotel in this city. We could name six or eight outstanding hotels offering fine accommodations at comparable rates.

Well then, what hotel should you stop at in Detroit? We say you'll like any of our leading hotels . . . but we ask that you give us a try.

We think we have a little extra to offer. It's difficult to describe this "little extra" but perhaps our long standing slogan can say it for us—

Aglow with Friendliness
HOTEL FORT SHELBY
DETROIT

J. E. Frawley, General Manager

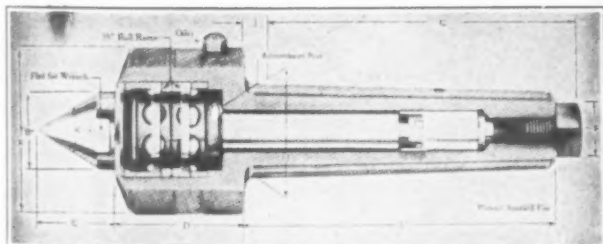
The Improved Nielsen Live Centers

LOAD CAPACITY—200 TO 40,000 LBS.
AT 100 RPM.

HAVE ADJUSTMENT TO TAKE UP WEAR
AND PRELOAD BEARINGS

STANDARD MORSE TAPER No. 2 TO 6
IN STOCK

Write For Catalogue



NIELSEN, INCORPORATED
LAWTON, MICHIGAN

JULY, 1942

Douglas PRECISION SLOTTER

FOR TOOLROOM AND PRODUCTION

Swiveling ram head
and tool holder, auto-
matic circular table
and independent
automatic feeds in all
directions.

Prompt Delivery
by
Large-Scale
Production

Built with
7", 8", 10"
Stroke



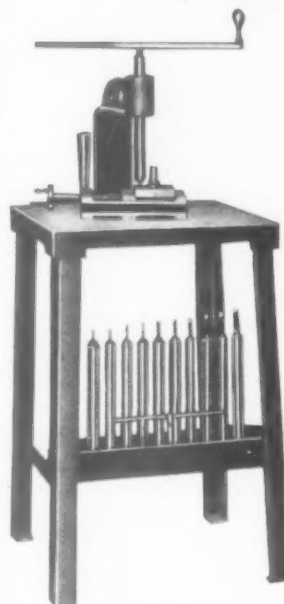
DOUGLAS MACHINERY CO., INC.

150 BROADWAY, NEW YORK, N. Y., Dept. 806-5

BE UP-TO-DATE!

Replace your Tap Wrenches
with the

**BAY STATE
HAND TAPPER**



This Tapping Machine cuts direct hand-tapping labor costs 75%. It makes quick, accurate tapping easy. Tap breakage is almost entirely done away with and spoiled work is held to a minimum. The spindle itself reaches down between projections thus doing away with tap extensions. This handy machine requires no setting up. Ready to use at once!

Ask for circular
No. 313

Write for complete literature

THE PRODUCTO MACHINE CO.
BRIDGEPORT, CONN. DETROIT—3017 MEDBURY

SHELDON Back Geared Screw Cutting PRECISION LATHES

For production:

Lever Operated Double Tool Posts
Lever Operated Collet Attachment
Lever Operated Tailstock

For any production jobs (often on second operation work) these moderate priced lathes will surpass in output much more expensive machine tools. Costing less than \$750. (with motor included) the 10" Sheldon Manufacturing Lathe (illustrated) comes with Hand Lever Collet attachment (Collet capacity $\frac{3}{4}$ "), Lever operated Double Tool Slide, Hand Lever Tailstock, Semi-Quick Change Gear Box. With 4-speed underneath motor drive enclosed in pedestal leg. It's a complete operating unit that can be set up anywhere.



Write for Catalog of 10", 11" and 12" Sheldon Precision Lathes.

SHELDON MACHINE CO., INC.
4252 No. Knox Street
Chicago, Illinois, U.S.A.

EVEREDE BORING BAR HOLDERS



The Everede Boring Bar Holders are adjustable to fit various size lathes. (Bushings are furnished with each boring bar for use in the Holders.) Everede Holders keep the boring bar in a horizontal position, regardless of any change in the size of the lathe, within limits.

The No. 1 Boring Bar Holder is used on precision bench lathes from 7" swing to and including 9".

The No. 2 Holder is used on engine lathes from 8" swing to and including 12", and the No. 3 Holder on engine lathes from 12" swing to and including 24".

The Holders are made of case-hardened alloy steel. A tool post block is attached to the engine lathe Holders by a chain as shown.

Send for descriptive folder.

EVEREDE TOOL CO.

Willis Stutson
184 N. WACKER DRIVE, CHICAGO
Representatives in principal cities

PASSING PARADE



H. STURGIS POTTER
Now at main office.

H. STURGIS POTTER of the Indianapolis branch of The Carpenter Steel Company has been transferred to the main office at Reading and appointed assistant manager of tool steel sales.

Died



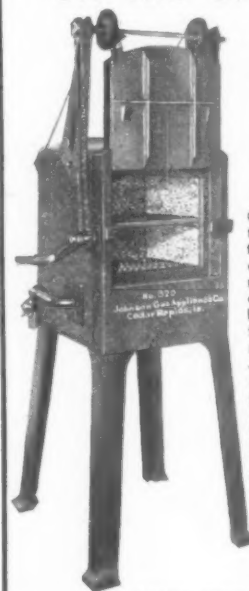
HOBART S. JOHNSON
Son of Gisholt founder.

HOBART S. JOHNSON, 68, Chairman of the Board of Directors and former president of Gisholt Machine Company, Madison, Wis., died May 28th at his Maple Bluff home after a long illness. The last surviving son of the founder of the Gisholt plant, Mr. Johnson resigned the presidency in 1940 and was succeeded by his son, Geo. H. Johnson.

THOMAS G. DOUGALL, Chicago district sales manager for the Columbia Tool Steel Company, died June 9th. Mr. Dougall was affiliated with the Columbia Tool Steel Company for 16 years in charge of Chicago sales. He was a member of the Superintendents' and Foremen's Club and the American Society for Metals.

MORRISON MACHINE PRODUCTS DIVISION of **HARDINGE BROTHERS, INC.**, Elmira, New York, has been discontinued. Their products, consisting of collets, feed fingers, pads, form tools and cut-off tools for automatics, turret lathes and chucking ma-

New JOHNSON Furnace ON THE OFFENSE



No. 820
Speeds
Tempering
and
Drawing

For 275° to
1200° F.

Quickly provides the heat for tempering tools, dies, small parts, non-ferrous metals and parts for heating aluminum forgings and rivets. Two large Johnson atmospheric burners provide even heat thruout the combustion chamber. Easily moved. Firebox 16" x 16" x 14". \$450 F.O.B. Factory.

Write for
FREE Details

SALES OFFICES:

Bourse Bldg., Philadelphia
120 Liberty St., New York City
C. B. Babcock Co., 475 11th St., San Francisco

JOHNSON GAS APPLIANCE CO.
550 E. Ave. NW. CEDAR RAPIDS, IOWA

T. H. L. FRONT LEVER BENCH PUNCH



Built for hard tough work — die cannot lose alignment with punch — all parts interchangeable.

Capacity $\frac{1}{2}$ " holes through $\frac{1}{8}$ " steel; $\frac{3}{8}$ " through $\frac{1}{4}$ " steel. Can also be made for holes up to $\frac{7}{8}$ " in thinner metal. Stock punches and dies available from $\frac{1}{8}$ " to $\frac{1}{2}$ " by 64ths.

Weight, 70 lbs.

**T. H. LEWTHWAITE
MACHINE CO.**

(Est. 1890)

307 E. 47 St.

NEW YORK

CLEVELAND

No. 1

NEW

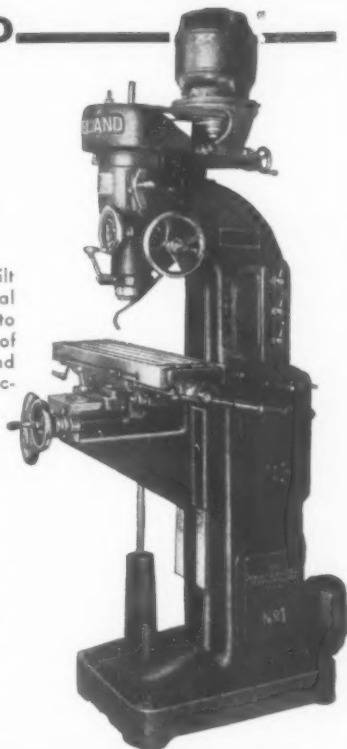
Vertical Milling Machine

Here's a new . . . rigidly built . . . high speed . . . vertical milling Machine designed to meet the growing demands of the modern Tool Room, Die and Mold Shop and many Production Plants.

Features:

Choice of two ranges of Spindle Speeds: 12 speeds 100 to 1750 r.p.m. and 12 speeds 200 to 3450 r.p.m. Table has 12 automatic longitudinal feeds ranging from 6" to 12 1/2" per minute. Capacity—Longitudinal Feed 18". Cross Travel 8 1/2". Vertical Travel 16". Table—Working Surface 8" x 32" with Three—1/2" T-slots 17 1/2" center to center. Power—11 1/2 H.P. motor, flange mounted with adjustable hand wheel for quick change of spindle speeds. Cutter Capacity—1/4" to 2 1/2" Mills. Floor Space—36" wide x 42" deep x 87" high.

Write for fully descriptive bulletin.



The SOMMER & ADAMS Company
CLEVELAND • • • OHIO, U.S.A.

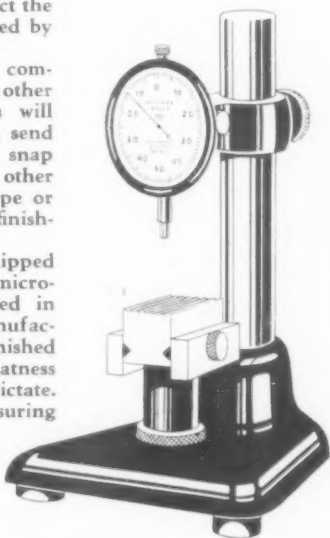
**COMPARATOR and SNAP GAGE
ANVILS RESURFACED**
by the ACME FLAT LAPPING PROCESS

★ Gage blocks and anvils, (serrated or plain), need frequent check-ups to detect the surface deviations caused by local wear.

To insure that your comparators, gages, and other measuring instruments will give accurate readings, send your comparator and snap gage tables, anvils, or other flat contacts of any type or style, to Acme for refinishing.

Because Acme is equipped to measure in terms of micro-inches, and experienced in extreme precision manufacture, surfaces can be finished to as near absolute flatness as your requirements dictate.

Be sure your measuring instrument anvils are accurate. Send them with any other flat parts to Acme for resurfacing today.



ACME INDUSTRIAL CO.

Makers of Hardened and Ground Precision Parts
208 N. Laflin St. Chicago, Ill.
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LYON

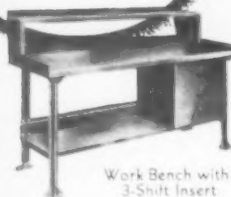
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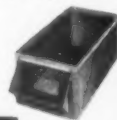
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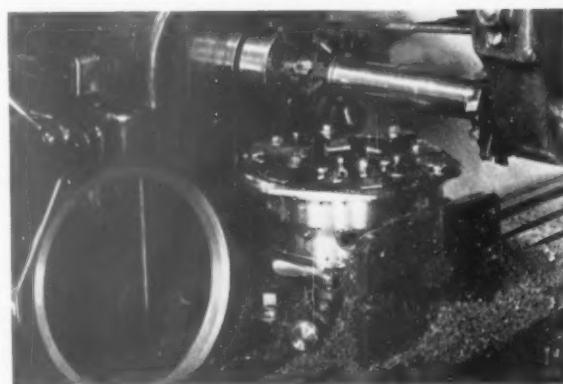


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PAUL HACKER has been appointed pump engineer in charge of sales at the Pioneer Engineering and Manufacturing Company, Detroit. Mr. Hacker was associated with the Packard Motor Car Company for 27 years as foreman of the tool-making department, and later the processing department.

HOWARD E. MILLS has been named district sales manager for The Wickman Corporation in the mid-west with headquarters in Chicago.

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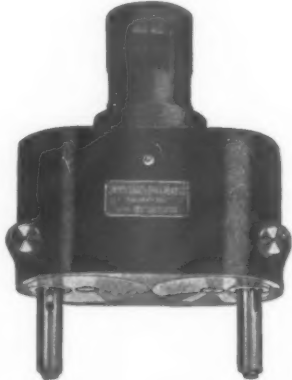
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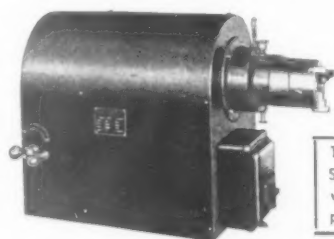
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(see page 3 for addresses)

Acme Industrial Co.	191	Glenzer Co., The J. C.	173	Pioneer Engineering & Mfg. Co.	134
Acme Machine Tool Co., The	163	Gorton Machine Co., George	6	Potter & Johnston Machine Co.	27
Ajax Steel & Forge Co.	173	Graham Mfg. Co., Inc.	176	Pratt & Whitney Div.	2nd Cover
Allegheny Ludlum Steel Corp.	145	Greenfield Tap & Die Corp.	66	Preis Engraving Machine Co.	184
American Designing & Engineering Co.	138	Greenlee Bros. & Co.	32	Procon Safety Chuck Co.	179
Ames Co., B. C.	165	Grob Brothers	182	Production Products Co.	173
Ampco Metal, Inc.	112	Hanna Engineering Works	185	Producto Machine Co., The	189
Apex Machine & Tool Co., The	127	Hannifin Mfg. Co.	64	Putnam Tool Co.	169
Armstrong-Blum Mfg. Co.	124	Hardinge Brothers, Inc.	21	Pyott Foundry & Machine Co.	193
Armstrong Bros. Tool Co.	187	Hartford Special Machinery Co., The	191		
Aro Equipment Corp., The	116	Haskins Co., R. G.	181	Racine Tool & Machine Co.	171
Arter Grinding Machine Co.	161	Haynes-Stellite Co.	50	Ransome Concrete Machinery Co.	178
Atlas Press Co.	126	Heald Machine Co., The	51	Ready Tool Co., The	175
		Henry & Wright Mfg. Co., The	186	Rehnberg-Jacobson Mfg. Co.	166
Baker Brothers, Inc.	48	Hobart Brothers	192	Rotor Tool Co., The	52
Barber-Colman Co.	42	Hole Engineering Service	167	Ruthman Machinery Co., The	178
Barnes Co., W. F. & John	28	Holo-Krome Screw Corp., The	2		
Barnes Co., Inc., W. O.	43			Schauer Machine Co.	193
Barnes Corp., John S.	4	Ideal Commutator Dresser Co.	181	Scherr Company, Inc. George	153
Blake Company, Edward	163	Illinois Tool Works	119	Schultz & Anderson Co.	174
Blanchard Machine Co., The	168	Independent Pneumatic Tool Co.	26	Scully-Jones & Co.	4th Cover
Bokum Tool Co.	177	Industrial Engineering Co., Inc.	175	Sellers & Co., Inc., Wm.	58
Boyar-Schultz Corp.	171	Ingersoll Steel & Disc Division	53	Seneca Falls Machine Co., The	9
Bradford Machine Tool Co.	154	International Nickel Co., Inc., The	59	Severance Tool Co.	150
Braeburn Alloy Steel Co.	155	Jarvis Co., The Chas. L.	61	Sheffield Corp., The	111
Breuer Electric Mfg. Co.	180	Jefferson Machine Tool Co.	185	Sheldon Machine Co., Inc.	190
Brewster-Squires Co.	183	Johnson Gas Appliance Co.	190	Sidney Machine Tool Co., The	49
Bromley Engineering Co.	46	Jones & Lamson Machine Co.	12-13	Siewek Tool Co.	181
Brown & Sharpe Mfg. Co.	3rd Cover			Skilsaw, Inc.	156
		Kearney & Trecker Corp.	5	Smit & Sons, Inc., J. K.	177
Carbide Fabricators, Division Morse		Knight Machinery Co., W. B.	170	Smith & Co., D. A.	177
Tool Company	135	Knu-Vise, Inc.	169	Sommer & Adams Co., The	191
Carboloy Co., Inc.	109			South Bend Lathe Works	24
Carborundum Co.	20	LaSalle Designing Co.	192	Standard Gage Co., Inc.	1
Carpenter Steel Co., The	44	Leach Machinery Co., H.	167	Standard Shop Equipment Co.	155
Cerro de Pasco Copper Corp.	185	Lewthwaite Machine Co., T. H.	190	Stanley Electric Tool Div.	56
Chicago Pneumatic Tool Co.	54	Lima Electric Motor Co., The	152	Starrett Co., The L. S.	100
Chicago Rawhide Mfg. Co.	173	Lincoln Park Tool & Gage Co.	139	Sterling Tool Products Co.	118
Chicago Wheel & Mfg. Co.	188	Lodge & Shipley Machine Tool Co.	122	Stokerunit Corp.	159
Christensen Diamond Tool Co.	144	Logan Engineering Co.	30	Strippit Corp., The	174
Cleveland Automatic Machine Co., The	107	Logansport Machine, Inc.	8	Strong-Carlisle & Hammond Co., The	161
Cleveland Twist Drill Co., The	55	Lombard Governor Corp.	157	Stuart Oil Co., Ltd., D. A.	110
Climax Molybdenum Co.	125	Lovejoy Tool Co., Inc.	25	Sturdimatic Tool Co.	183
Columbia Tool Steel Co.	179	Lyon Metal Products Co., The	191	Sturtevant Co., P. A.	115
Comtor Co., The	169			Sundstrand Machine Tool Co.	39
Continental Machines, Inc.	23	Macklin Co.	196	Sunnen Products Co.	143
Copperweld Steel Co.	57	Martindale Electric Co., The	175	Super Tool Co.	158
Cullen-Friestedt Co.	172	Master Chrome Service, Inc.	121	Swartz Tool Products Co., Inc.	159
		Master Tool Co., Inc.	121		
Dalzen Tool & Mfg. Co.	37	Mathews & Co., Jas. H.	171	Taft-Peirce Mfg. Co., The	185
Danly Machine Specialties, Inc.	192	Mattison Machine Works	38	Tannewitz Works, The	128
Davis Boring Tool Division	33	McCrosky Tool Corp.	142	Thompson & Son Co., Henry G.	151
Delta Mfg. Co., The	47	McKenna Metals Co.	162	Timken Roller Bearing Co., The	60
Detroit Broach Co.	130	Micromatic Hone Corp.	10-11	Tomkins-Johnson Co., The	140
Diamond Tool Co.	193	Mid-West Tool & Mfg. Co.	18	Tungsten Electric Corp.	160
Dia-Tool, Inc.	114	Modern Collet & Machine Co.	180	Turner Uni-Drive Co.	36
DoAll Co., The	176	Monarch Machine Tool Co., The	133	Tuthill Pump Co.	177
Douglas Machinery Co., Inc.	175, 183, 189	Monarch Steel Co.	164		
Duncan Tool Designing Co.	176	Moore Mfg. Co., William	178	Union Carbide & Carbon Corp.	50
		Morey Machinery Co., Inc.	180, 182, 187	United Precision Products Co.	172
Eastern Cutter Salvage Corp.	121	Morse Tool Co.	135	United States Drill Head Co.	192
Elmes Engineering Works, Charles F.	19	Morse Twist Drill & Machine Co.	137	U. S. Machine Tool Mfg. Corp.	187
Empire Tool Co.	120	Motor Tool Mfg., Co.	195	U. S. Tool Company, Inc.	129
Enterprise Machine Parts Corp.	132	Murphy Machine & Tool Co.	40	Universal Engineering Co.	183, 187
Etico Tool Co., Inc.	179				
Evans Flexible Reamer Corp.	193	National Acme Co., The	16-17	Vanadium-Alloys Steel Co.	Front Cover
Everede Tool Co.	190	National Broach & Machine Co.	31	Van Norman Machine Tool Co.	141
Ex-Cell-O Corp.	35	National Tool Salvage Co.	180	Vascaloy-Ramet Corp.	22
		National Twist Drill & Tool Co.	41	Vinco Corp.	169
Federal Products Corp.	45	Niagara Machine & Tool Works	167		
Firth-Sterling Steel Co.	14-15	Nielsen, Inc.	189	Warner & Swasey Co.	99
Fort Shelby Hotel	189	Norton Company	62-63	Welding Equipment & Supply Co.	151
				Weldon Roberts Rubber Co.	165
Gairing Tool Co., The	34	O K Tool Co., The	153	Wells Mfg. Co.	171
Gallmeyer & Livingston Co.	184	O'Neil-Irwin Mfg. Co.	184	Westinghouse Electric & Mfg. Co.	7
Gammans-Hoaglund Co., The	179	Oster Mfg. Co., The	113		
Garrison Machine Works, Inc.	182	Ott Machinery Sales, Inc.	182	Yoder Sales Co., The	157
Giern & Anhalt Tool Co.	184	Ozalid Products Division	117	Ziegler Tool Co., W. M.	181
Gisholt Machine Co.	29				

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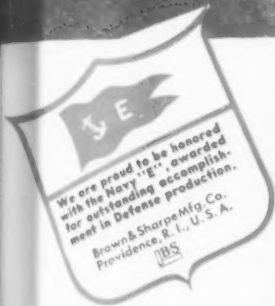
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